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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

ISSUED WEEKLY BY THE
AMERICAN MACHINIST PUBLISHING CO.,
256 BROADWAY, NEW YORK.

Some Leading Articles in this Number.

Some Tools in Prof. Sweet's Shop.
Some Personal Reminiscences, by Washington Jones.
Building a Great Dynamo.
Mechanical and Electrical Work and Power.
Method of Holding Work on Grinder Plates.
New Triple-Expansion Engine for Electric Generation.
Some Stamping Tools.

NINETEENTH YEAR.

No. 18.
April 30
1896.

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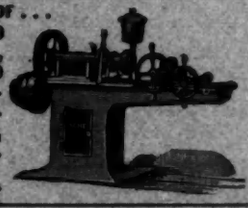

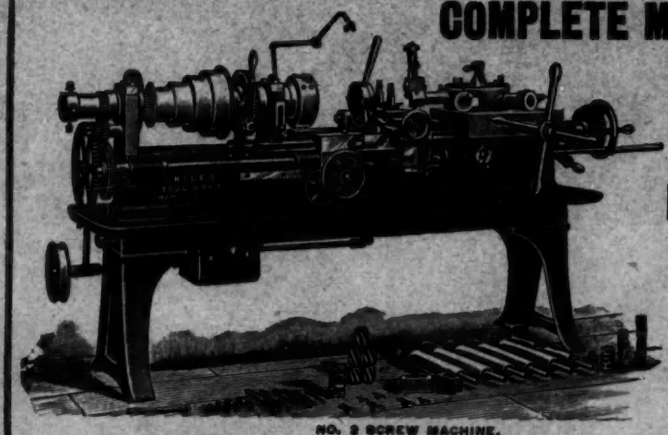

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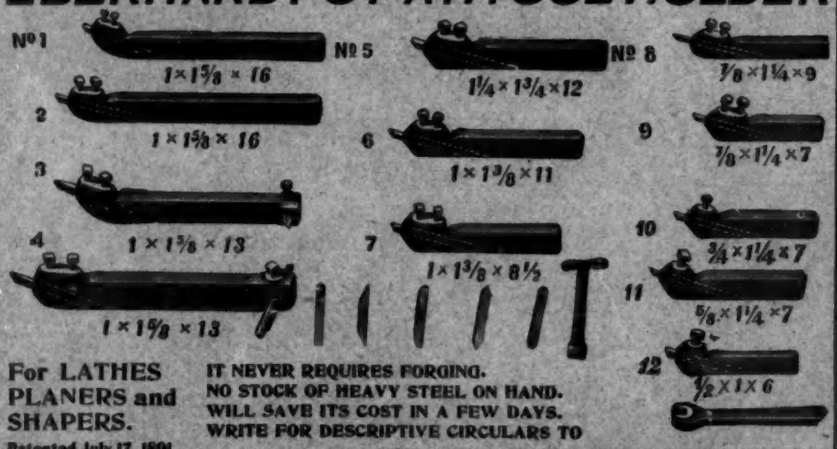

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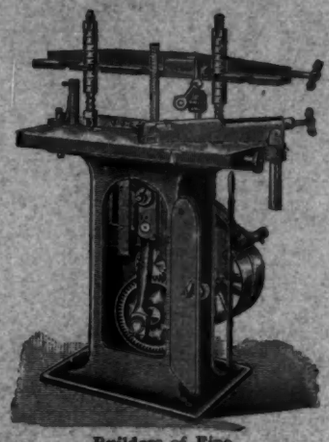

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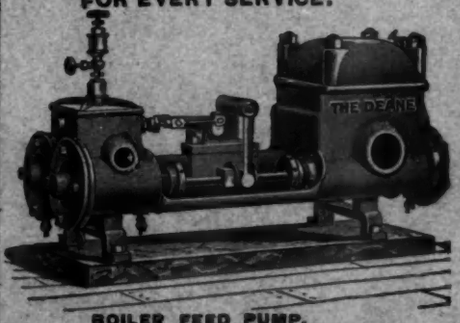

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AMERICAN MACHINIST

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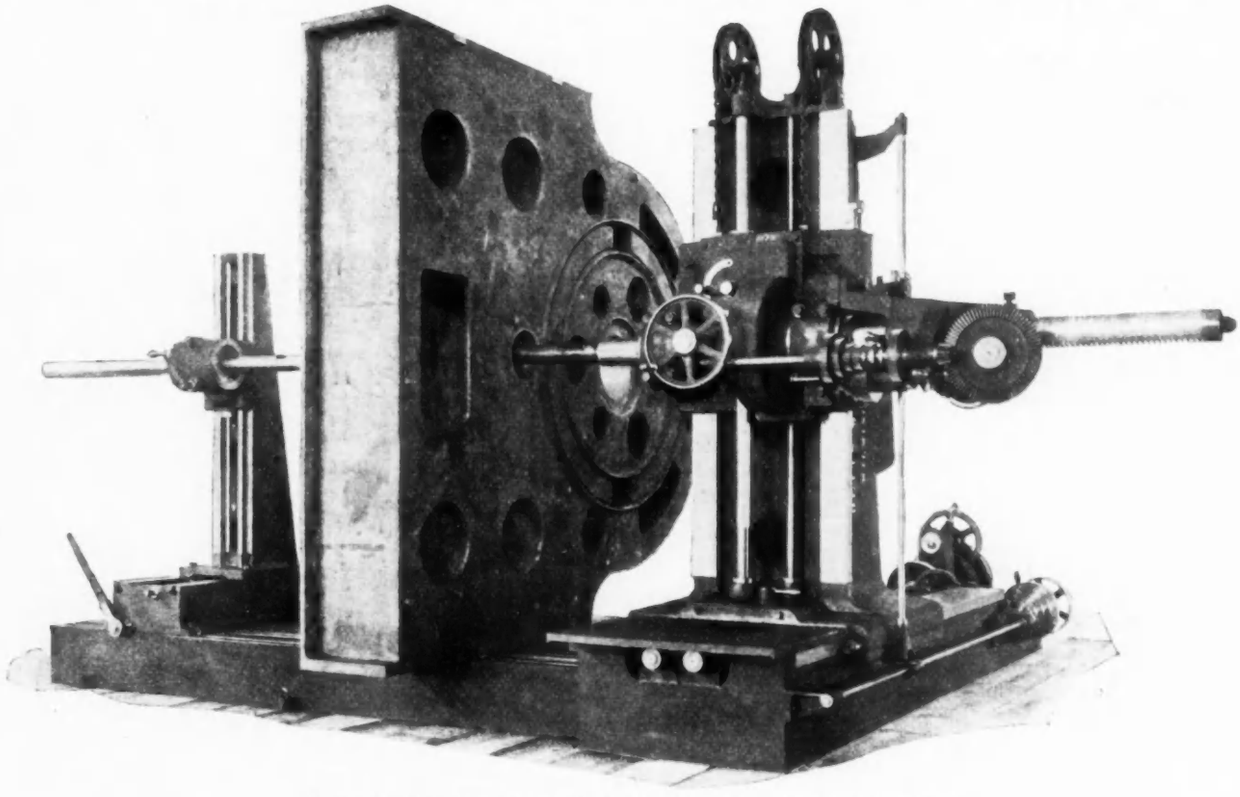
NEW YORK, THURSDAY, APRIL 30, 1896.

VOLUME 19. ▲ ▲ ▲ NUMBER 18.

A New Horizontal Boring, Drilling and Milling Machine.

We illustrate a new and interesting machine built by the Betts Machine Co., Wilmington, Del. It is, as will be seen, a strong and substantial tool; and, while doing all drilling and boring within its range, it is also especially adapted for heavy milling, often doing work that would otherwise require a very large planer. The half-tone shows the machine at work upon a 10-16 foot boring and turning mill bed plate, made by the same firm. The spindle is of steel and 5 inches in diameter, powerfully geared and with ten changes of speed, running in either direction. It has 31 inches of longitudinal movement, either by hand or power, and with all the while a full bearing in the cast-iron sleeve. Six positive feeds move the spindle in either direction without reversing its motion.



A NEW HORIZONTAL BORING, DRILLING AND MILLING MACHINE.

The column moves transversely 73 inches, and the spindle carriage moves vertically 49 inches. For milling there are five feeds in either direction, horizontally and also vertically. The minimum distance from table to center of spindle is 25 inches, and the maximum distance is 74 inches. The bolting surface of the table for work is 11′ 6″ x 6′, and 12 inches deep, with suitable T-slots and heavy ribs. Quick traverse by power is provided for the column and the spindle carriage. The outer support for the boring bars is mounted upon a carriage, with rapid rack-and-pinion hand adjustment on the table and secure fastening. The weight of the machine complete is 33,500 pounds.

▲ ▲ ▲

In 1883 the production of aluminum in the United States did not exceed 83 pounds for the year. This year it is estimated that not less than 6,000 pounds per day will be produced.

Bed and Cylinder Tools—"Straight Line" Engine Shop, Syracuse.

The "Straight Line" engine frame, like most carefully designed principal machine parts of the present day, lends itself very readily to finishing operations in special fixtures. Probably Professor Sweet's first idea of the "Straight Line" engine frame, with the steam chest, cylinder, frame and shaft bearings cast all in one piece, was not a direct outcome of previously conceived finishing methods; but the really expert designer thinks so constantly and so unintentionally in and along tool-making and finishing operation lines, that it is hard to say when such a mind has a new design in contemplation, whether he makes the piece to fit the tools which will readily finish it, or makes the tools to finish the piece. It is almost impossible to separate the thought of the piece from the vision of the finishing tools by which the piece is to be machined; and

perhaps it is pretty nearly correct to say that both the piece and the tools to finish it come simultaneously into the mind of the designer who is an expert special tool and fixture maker. However this may be, it is quite certain that the "Straight Line" engine cylinder and frame, cast all in one piece, is very easy founding and very easy finishing, and that the special tools used in finishing the frame are also very simple, very certain in action and very easy to build.

Besides all this work saved at the outset by the strictly thinking part of the designer, these tools are used and the frames are finished in one of the very few examples of saw-tooth roof machine shops in this country; and hence, Mr. Sweet is not forced to select machinists with the visual peculiarities of bats, moles and owls to use his special tools. Quite on the contrary, the "Straight Line" engine floors are among the very best lighted machine-shop floors in the United States, and afford most cogent arguments in favor of the saw-tooth and single-floored shop for medium weights of work to be found among our industrial establishments. These shops are very unpretentious from the outside, and no exterior view can be obtained to give any adequate idea of the shop construction.

Sweet's large vertical-spindle milling machine (which he calls a "traversing machine"), built by Pratt & Whitney, shown in Figs. 1 and 2, has been illustrated and described, and will not be minutely noticed here. The general appearance of this tool is shown in the engraving, ready to begin work on an engine bed. Fig. 2 is an enlarged view of the saddle. The spindle has a very great range of speeds, from 300 or 400 turns per minute, suitable for a small drill, down to the five or six turns required for a face mill of 8 or 10 inches diameter. The table has a friction-disk feed drive, giving any speed of table and saddle drive from nothing up to its highest rate; and altogether this milling machine is a very favorable example of a quick, handy tool for making light end-mill cuts. The ports, valve faces and steam-chest cover seats are all machined on this tool, which is in constant use and gives great satisfaction; although, like every first tool, it is, to let Professor Sweet tell the story, "susceptible of some improvements." It is, in my own opinion, a better-arranged machine for the work it has to do than any other vertical-spindle machine I have ever seen, and it is also a tool which would find plenty to do in almost any engine-building shop in the country.

Professor Sweet favors a novel construction for end mills too large to be cheaply made in a single piece, which construction is quite clearly shown in Fig. 3. His method of making end mills is to set the tool-steel teeth in the sand, at an angle of about 45 degrees to the proposed finished tool axis, and hold them in that position by casting the body and shank of the mill about the teeth in gray iron. I have seen mills made in this manner, broadly, before, which were not regarded as giving very favorable results. The edges of these teeth were perfectly good, and tempering had not loosened them in the gray-iron body in the least. These cast-iron body end mills are the regular standard tool in the Sweet shops, and are perhaps the cheapest inserted tooth end mills that can be made. For larger sizes I noticed inserted tooth end mills more nearly on ordinary construction lines. The face angle or "rake" of these mill teeth was, in some cases at least, 10 degrees, although it looks to be radial in the picture. There is no doubt as to the propriety of giving a face angle to mill teeth for gray-iron cutting. I know of a face angle as great as 30 degrees in experimental use, and when the effect of this extreme "rake" is fully decided I shall have more to say about it, as the experiment is on a large scale and is being fully tried. The Sweet gray-iron body mills have taper shanks with feathers, as shown, for the small ones, and the large ones screw on the spindle nose in the usual manner.

The principal drilling machines in these shops are arranged with reverse spindle drives, so that they can be used for tapping as well as drilling, and one has a deep pit, and another, facing the pit driller shown in Figs. 4 and 5, has a very large planed and T-grooved sole plate, set almost level with the floor, the utility of which will be understood without extended comment. In addition to the usual angle plates and drilling blocks, the largest drilling machine is served by the 4-wheel carriage, which has a planed gray-iron top, with cross lines of T-grooves, and is furnished with special pedestals for the two ends of the regular sizes of the "Straight Line" engine frames, as quite plainly shown in Figs. 4 and 5, so that the frames can, by use of this carriage, be placed and drilled with vastly more ease and accuracy than by blocking them upon the drill bed. The carriage wheels on the left-hand side, Fig. 5, have flat treads; on the right-hand side they have a rib in the middle of the flat tread which fits a groove in the track rail; the track rails are planed, and a screw clamp is built into the wagon top to clamp the left front wheel to the top rigidly, to make the wagon stand still. The engravings show the convenience secured by this carriage, but they do not show how the carriage can make a drilling machine turn off about twice as much work as could be done without it. In Fig. 5 it will be seen that the carriage stands back on its track, well out of the way of the machine, so that there is plenty of room to work all about the driller itself, the same as if the carriage was not in use at all, and that a workman is in the act of scribing holes to be drilled in a flat cast-iron frame clamped down to the sole plate. Now, it is well known to all who are familiar with the use of the radial drill on rather heavy work, that the driller is seldom actually drilling holes more than half the time; the other half of the time is taken up with setting work and laying out holes ready to be drilled. While this flat frame shown on the driller sole plate was being leveled up, clamped down, and laid out ready to have the six short holes drilled in its hubs, another man was at work placing an engine frame on the carriage, and making it ready so that when the carriage was run under the drill spindle the driller could work steadily until all the holes were bored and tapped in the frame. Then the carriage can be run back, out of the way, leaving the driller free for use on other work while another piece is put on the carriage. Most drillers which are equipped with a traveling carriage are not so made that anything can be placed for drilling on the machine while work is being made ready on the carriage.

Many a foreman who thinks he is pretty well up in labor-saving devices and methods could learn something new by a visit to the "Straight Line" shops, which, instead of the "Positively No Admittance" sign, have the legend "Visitors Always Welcome" over the door. I do not mean that these shops are simply open to those who have suitable credentials; there is an actual sign-board reading as stated at the door, and I thought I must be dreaming when I read it. There is not a more instructive shop in this country so far as tools are concerned, and it is wide open to all who wish to take advantage of its lessons. It is really quite shocking to think that Professor Sweet should be thus absurdly willing to "give away" his ideas, and "to educate the public" at his "own expense"; but, strange as it may appear, it is the rule throughout the United States that the shops which have the least to show in the way of good modern practice are usually the ones most difficult of access, and I always feel pretty certain when the managers of an establishment begin to talk about "educating the public at our expense" that the "public" don't lose much by being denied a knowledge of their practice. The truth of the whole matter is, that no "one-man" machine shop can possibly be an up-to-date establishment; one man may be very smart, but no one man is so intelligent as all the rest of the world put together, and in a multitude of counselors there is wisdom. No shop has locked up in its safe any patent on the most improved methods of doing general machine work, nor does the head of any one man in any of those jealously guarded establishments contain any ideas which entitle him to say he is the boss machinist of the country. There are better shops wide open to the public than any of the locked-up establishments, and the "Straight Line" engine shops are a shining example in point of illustration.

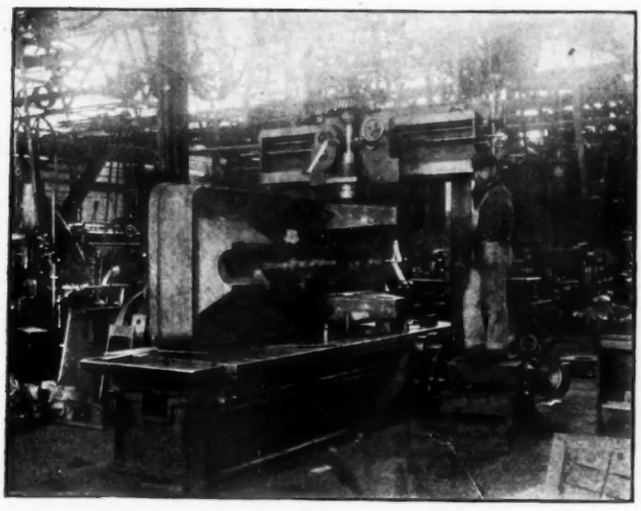


Fig. 1. SWEET'S VERTICAL-SPINDLE MILLING MACHINE.

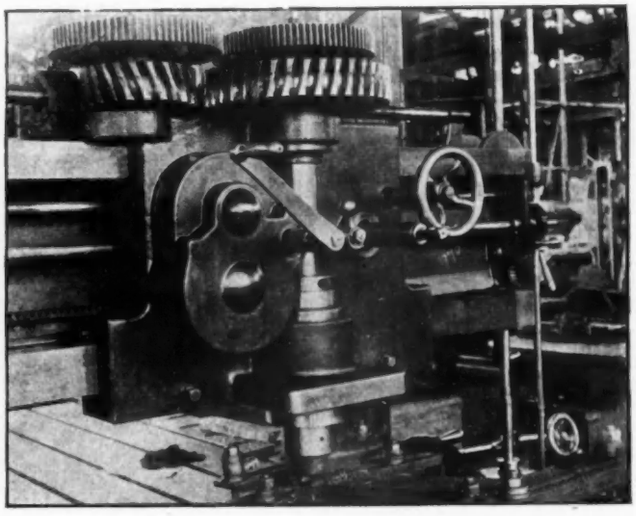


Fig. 2. SADDLE OF SWEET'S MILLING MACHINE.

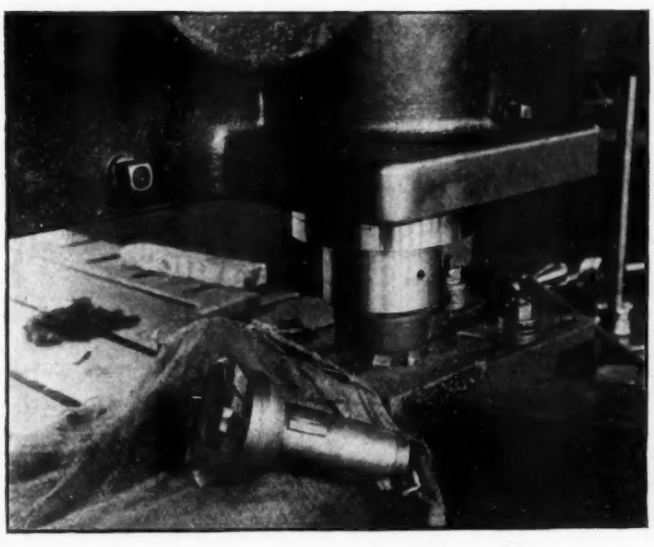


Fig. 3. SWEET'S END MILL.

Fig 4. DRILL PRESS LOADED.

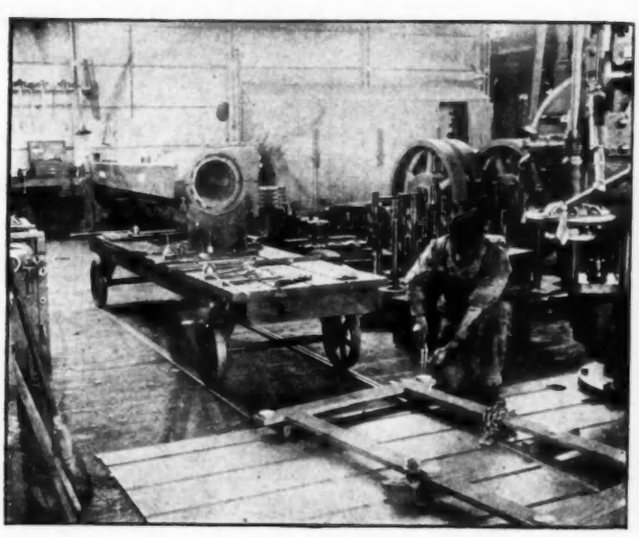


Fig. 5. CARRIAGE FOR DRILL PRESS.

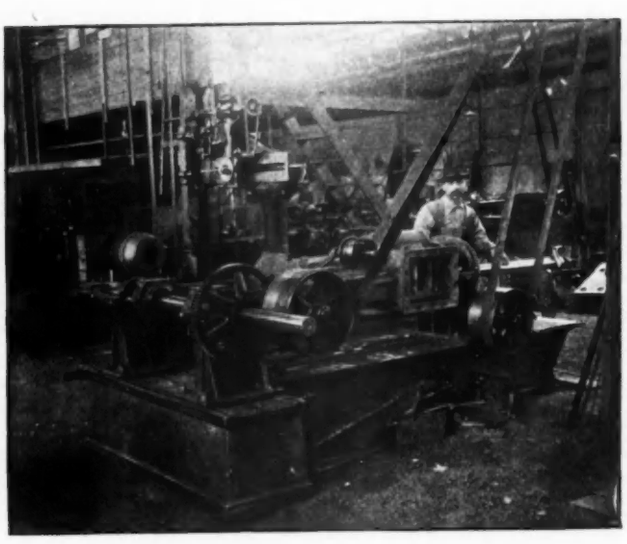


Fig. 6. SWEET'S BORING MACHINE.

The "Straight Line" cylinder and main-bearing boring machine is shown in Figs. 6 and 7. It is a very simple and very convenient machine, and did not cost much money. The bed is T-shaped, good and deep, has a planed top with T-grooves, and is fitted with pedestals which support the different-sized frames, the feet of the pedestals being adjusted to position for different sized frames in the T-grooves in the top of the bed. The journal-box boring bar and the cylinder boring bar are necessarily at right angles to each other, and both are driven from the one countershaft, the cylinder bar being worm-geared, while the other has a spur gear and pinion reduction from the pulley shaft. The fourth pedestal, seen under the middle of the frame in Fig. 7, carries the inner end of the cylinder boring bar. The engravings make the general conception of this very neat boring machine perfectly clear, and minor details of a special tool are not often of general interest—it is the broad idea only which is of value to the public.

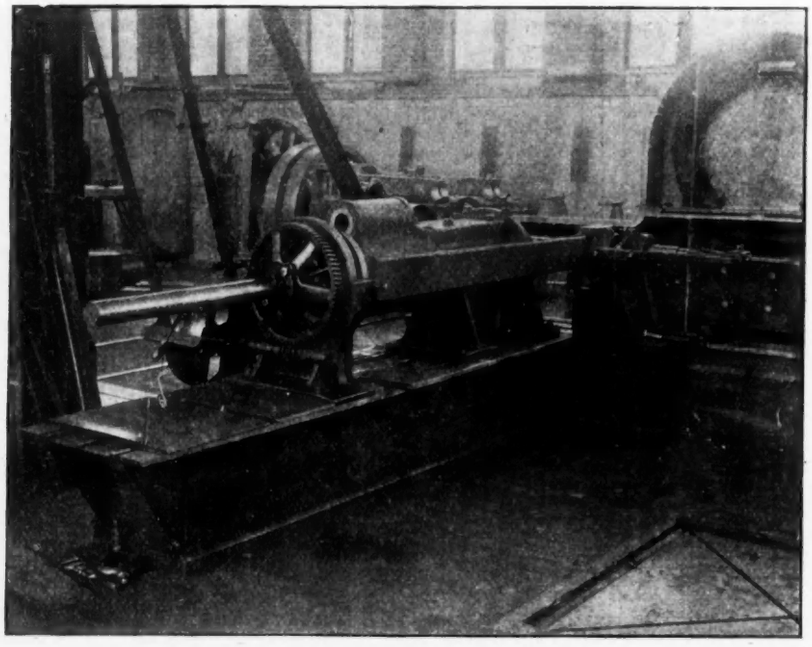


Fig. 7. SWEET'S BORING MACHINE.

The "broad idea" in the case of this Sweet boring mill is the conception of the T-sole plate, or bed, flat and T-grooved on top, with the journal-box boring bar and the cylinder boring bar at right angles to each other, carried in adjustable pedestals—one bar driven by spur gearing, and the other bar driven by a worm-gear reduction, so that both boring bars can be readily driven from the same countershaft. All styles of engine beds of small and medium sizes could use a boring mill after this general plan to excellent advantage. As is very well known to readers of this paper, it is not new to use two or more boring bars in the same cylinder boring machine, nor is it new to mount such bars in adjustable pedestals, nor to place the boring bars at right angles to each other. But, for all that, I have never before seen an engine frame and cylinder boring machine like this from the "Straight Line" shops; and this is, it seems to me, better adapted for a general design of a slide-valve engine boring mill than anything before shown in these Bed and Cylinder Tools papers. The cylinder boring-bar drive might very well be given the variable-speed advantage gained by the Bullock method of worm-driving, shown on page 641, last year. Otherwise I did not note any point where this extremely cheap and handy machine was wide open to detail improvement. It is, of course, perfectly easy to obtain the variation in cylinder-bar speed by changing the driving pulley on the countershaft, but I am in love with the Bullock worm-drive change of speeds referred to above.

Figs. 8 and 9 are given to show the general appearance of a saw-tooth-roof-lighted machine shop, and the very peculiar hand-operated traveling cranes, Sweet's design, which weigh only two tons each, and handle five tons weight very easily.*

HERMAN LANDRO.

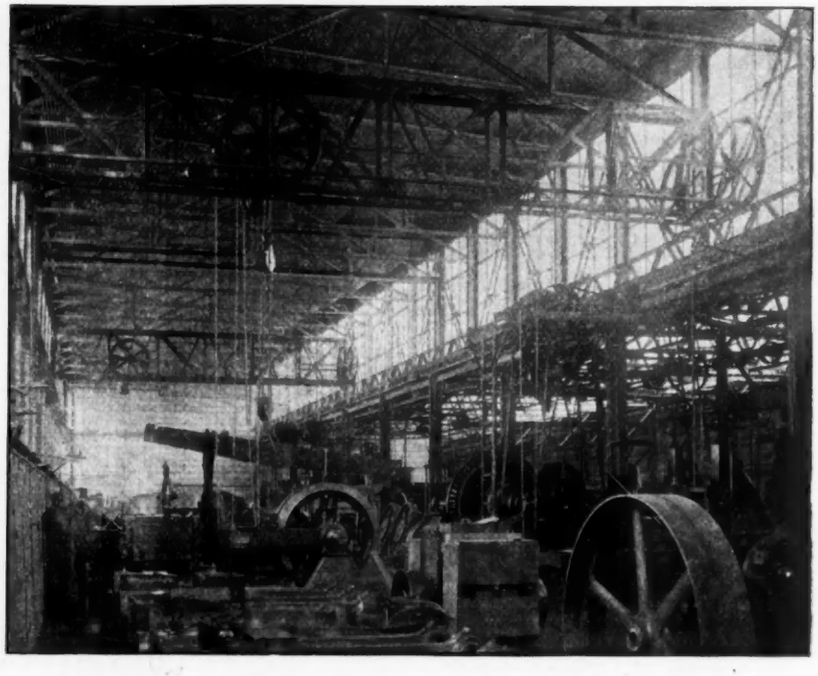


Fig. 8. "STRAIGHT LINE" ERECTING FLOOR. 5-TON HAND CRANES.

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The Slow Growth of Inventions.

It takes a great many years for inventions to attain such a commanding position in the world as to divert the course of social or national life. It is entirely beyond experience that a man should walk out of his laboratory bearing in his hands a machine capable of instantly revolutionizing the present order of things. That is why sensible men give no credence to matters like the Keeley motor, which is to produce unlimited power without cost. Without entering into questions of the ability and integrity of its author, or into the value of the small amount of evidence which is procurable concerning his inventions, they are justified in deciding that the claims put forward are far beyond the truth. Coming events of such magnitude cast very long shadows before them, and when their prefigurements cannot be seen

*Working drawings of this crane were published in the "American Machinist," February 12 and March 5, 1891—Ed.

it is wise to doubt their existence. The humiliating fact must be faced that no man is capable alone of inventing and bringing to perfection any great mechanical innovation. There is always some little thing that hinders progress quite as effectually as any of the greater ones. What an immense time it took to introduce the surface condenser at sea, and yet, with our present knowledge, what a simple affair it is! High-pressure steam had to await the advent of heavy mineral oils and metallic packings before it made much progress. The water-tube boiler struggled for recognition for years, and only obtained it when evaporators were constructed to provide a pure feed. And so on. One generation sows and another reaps, and it is well that it is so, else we should always be in a condition of change and turmoil. The ordering of our lives would be like the building of one of Her Majesty's ships under the old régime, when the construction of an ironclad was made to extend over eight years, and the design was repeatedly altered to secure the adoption of every new idea brought out during the period. Doubtless mechanical improvement will make much faster progress in the future than it has done in the past, but, on the other hand, our expectations will reach further ahead, so that we shall not realize our anticipations much more quickly than we do now. We doubt if the youngest among us will live to see the realization of Sir Benjamin Baker's forecast of the production of unlimited power by drawing on the momentum of the earth, or Professor Crookes' suggestion that it will be possible to obtain inexhaustible stores of energy from the ether.—London "Engineering."

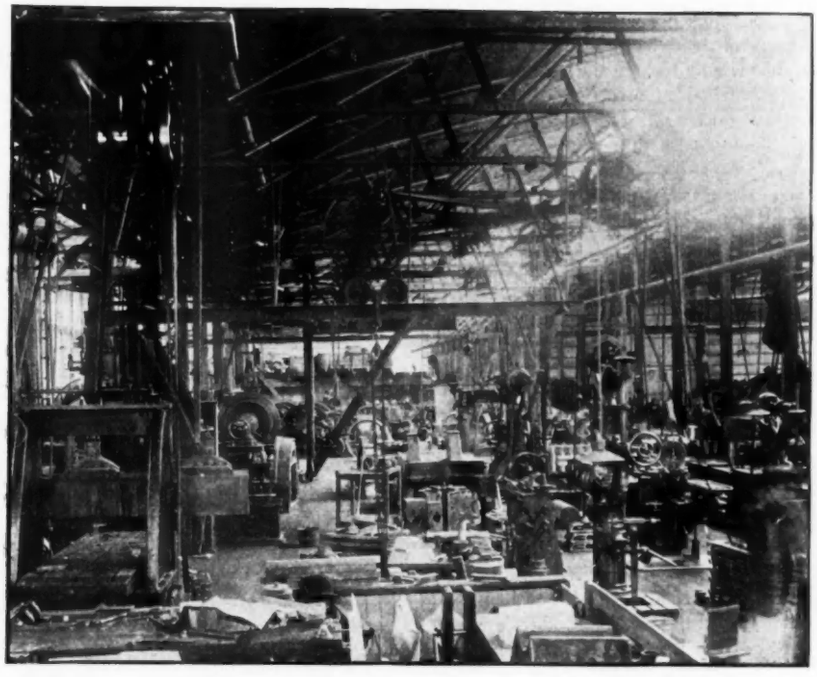

Fig. 9. "STRAIGHT LINE" MACHINE SHOP." SAW TOOTH" LIGHT.

Investigating Mexican Trade.

President Search, of the National Manufacturers' Association, is taking the proper steps to enlighten the manufacturers of this country regarding trade with foreign countries. A special delegation was sent out some time ago to report on the trade advantages of Japan, Mr. Porter being at the head of the committee. Another special expedition has just been sent to Mexico, to interview President Diaz regarding the Exposition which the Mexican Government propose to hold in 1897. They will also visit the principal cities of Mexico and report as to the outlook for trade with that country. This delegation is composed of Mr. Chas. Davis and Mr. Robert D. McGowan, both of Cincinnati, and Mr. T. A. Martin, of Atlanta, Ga.

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A New Emery Grinder.

We present herewith an illustration of a grinding machine which is representative of a line of similar machines now being made by the Builders Iron Foundry, Providence, R. I.

The principal features of the machine will, of course, be readily understood from the engraving, and it is only necessary to say that the machines are designed to supply the demand for the better class of such machinery.

The machine shown is designed for wheels up to 14-inch diameter, 2½-inch face. The spindles are made of mild steel ground true, and are run in bearings of unusually large dimensions, provided with tongued and grooved caps and made dust-proof. Oil is held in reservoirs underneath the spindle, and there is an arrangement for constantly feeding it to the bearings. Provision is made for taking up wear, and the machine has removable, interchangeable boxes.

A water attachment can be supplied by which the wheel is kept flooded for wet grinding, and this is arranged to keep the water only where it is needed and to afford a convenient rest for tools.

The upper part of the machine can be separated from the column and bolted to a bench if desired.

EMERY GRINDER.

Similar machines are built in five sizes for wheels ranging from 8 to 18 inches diameter. The new and very excellent countershaft which we illustrated in our issue of February 20th was designed especially for use with these grinders.

▲ ▲ ▲

We have received from George W. Graeff, Secretary, circulars explaining the objects of the newly-formed National Association to Establish a Sound Currency and Banking System. This association is located at 624 The Bourse, Philadelphia, Pa., and is undoubtedly engaged in a work of very considerable importance to every citizen of the United States. Those who are interested can obtain further information regarding the association by addressing the Secretary as above.

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A bequest made by the late George Babcock, for the purpose of providing technical and scientific books to the Plainfield, N. J., Public Library, seems likely to be rendered unavailable by the refusal of the City Council to appropriate the $7,000 needed for the required addition to the library building. There is probably not the slightest reason to doubt that Mr. Babcock, when living, could have easily made the arrangements complete, and it is sad to see such bequests so frequently rendered entirely futile.

Some Recollections of Machine Shops in the Early Forties.

BY WASHINGTON JONES.

Some time since I gave to the readers of the "American Machinist" some account of my early experience in machine shops, and, upon request, now continue the subject.

The "cub" now having finished his work on the "Mississippi," was detached from that ship and ordered to report at the shop in Philadelphia, and at this time, having gained some proficiency in the use of the file and lathe tools, was approaching the condition where, metaphorically, "kicks became fewer and coppers more frequent," no less than two hundred and twenty-five of the latter passing to his credit weekly. These were not extravagant wages for apprentices, but the customary rate at that period, and just about enough to keep body and soul together without anything over for luxuries, such as cigars and tobacco, which the cynical might intimate was a wise precaution of the employers to prevent the bad habits of smoking and chewing. Fortunately for them, the majority of my fellow apprentices belonged to families in easy circumstances and had received fair English educations, and, thanks to it and to the excellent opportunities afforded them to acquire the knowledge which comes through "the finger ends," all of them became good mechanics. Several eventually entered the naval service as engineers, and six or seven rose to be chiefs. The "cub's" predilections, after a service of five years, kept him ashore, and the advice of his senior boss (Mr. S. V. Merrick) confirmed them.

In the early part of his apprenticeship he had acquired a tolerable knowledge of "scale, dividers and bow pen," and his teacher of drawing recommended his "junior boss" (Mr. J. H. Towne), who at that time made all the designs for the machinery constructed in the Southwark Foundry, to employ him, when he needed an assistant, to make tracings, to enlarge drawings intended for use in the work shops, etc.; so, when the occasion arose, the "cub" was ordered to wash his hands and report to the drawing-room, and thus the "cub" was elevated to the dignity of an assistant.

Now, this drawing-room was a cubby hole about ten feet square, situated in a corner of the third floor of the machine shop, and was partly occupied by the truss girders of the crane used to hoist work on and off a large boring mill on the ground floor. It had one window, facing the east, before which was the drawing-board of the junior boss, and between it and the rear partition was an empty flour barrel upon which was placed the "assistant's" drawing-board. Part of his duty was to put in their place, upon the general designs, such details as were made by the junior boss. By this procedure interferences were detected sometimes, and corrected before the work had been put into hands. Owing to close supervision, and "raps over the knuckles" for mistakes or carelessness, the "assistant" advanced and was put into more convenient quarters which had a better light, a stool to sit on and a table to spread out drawings on.

I should remark *en passant* that at that time mechanical draftsmen, as a class, had not been evolved from what a "brother chip" has wittily termed the "Chalk Age." Architectural draftsmen, generally Germans, were to be found occasionally in machine-shop drawing-rooms, and to their training and tastes may be attributed the reproduction in metal of designs and external details appropriate to stone structures only. Happily a later, better taste, and a knowledge of the "eternal fitness of things," have consigned all that stuff to limbo, and esthetic eyes are no longer offended by seeing in machine construction, Gothic columns and arches, fluted columns, entablatures with ogee moldings, rosettes, triglyphs, foliations, etc., where the restriction to architectural effect was to produce only such shapes as could be molded in foundry sand. The "assistant," when he sharpened pencils on his own account, pleads guilty to having followed, "in his green and salad days," such pernicious examples, and is thankful that none of his productions of those days, before the scales fell from his eyes, are extant to reproach him, and that he had soon learned that "machine construction has an architecture of its own."

Mention has been made of the drawings for the engines designed by Capt. John Ericsson for the United States steamship "Princeton." These were all made by his own hand, and were marvels of neatness and accuracy to scale. One of the "assistant's" duties was to dissect the originals and make enlarged copies (full size when possible) for use in the workshops. In this connection, I remember one occasion when, on handing to the late Angus Macpherson, then the very capable foreman of the smithy, a lot of drawings of wrought-iron details for gun platforms, recoil-checking apparatus and the tracks for them to run on, for the "Princeton's" wrought-iron guns—one in especial, a ring of about 6 feet diameter, of 5 x 1-inch bar, joined by four arms to a central piece to take hold of a pivot, and which was a difficult forging to make, he remarked, after an examination of them: "I think Captain Ericsson is trying to find out what we can do in smith work." But they were made, and satisfactorily too.

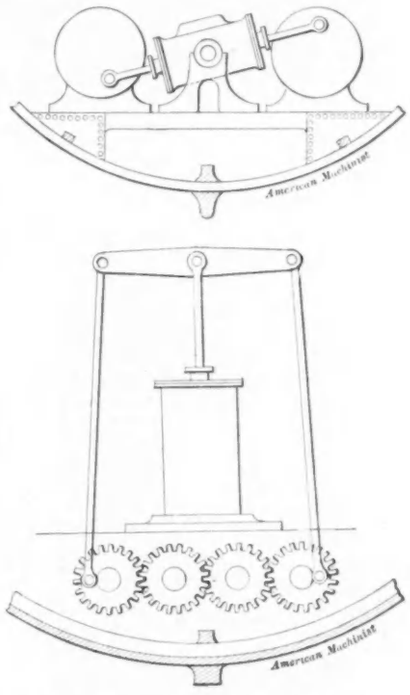
The close study required for this duty was of lasting benefit to a learner. Nothing in them was designed for the sake of ornamentation, but for plain service. Amongst all the details only one oversight is recalled: On the trial trip down the Delaware, thumping was developed in the hot well of starboard engine, which increased until the cover cracked and discharged a shower of hot water. It was patched up by placing timber posts between it and the deck beams directly over, when the ship was put about and returned at reduced speed to the Navy Yard for repairs. This cover was flat and bolted to hot well, and the joint was made of heavy canvas with both sides smeared with thick red-lead paint—the method in vogue at the time. Gum for joints had not been invented. Of course, the air escaped from hot well through the interstices of the cotton threads of the canvas, and the cushioning then having ended, the hammer blow ensued and fracture.

An inquest was held in the office of the Southwark Foundry, and the drawing of hot well submitted in evidence. During the deliberations of Captain Ericsson, the bosses and Mr. Harrison, chief engineer of the ship, upon the cause of the break and the best means to prevent a recurrence, Mr. Harrison (who had been brought over from England by Captain Ericsson to superintend the building and erection of the engines in the ship, as he had been frequently employed on previous occasions by Captain Ericsson) remarked: "Please, sir, Captain Ericsson, I think there must have been (h)air in the 'ot well." With an indignant look at him, the captain exclaimed in a reproving tone: "My God, sir! that is just what was wanted." After an impressive silence the verdict was rendered—"Died from deprivation of air." Then the "assistant" was instructed to make a drawing of a dome-shaped cover, which would confine the air above the joint so as to make a cushion. When applied, the plan proved to be a corrective of the trouble, and nothing more was heard within the hot wells. Although the performance of the engines was so satisfactory, and they proved to be so durable as to outlast the original hull, and good enough to be placed in a new one, no others on the same plan were made.

The successful performance of the machinery of the two warships established the reputation of the Southwark Foundry, and was the means of bringing in many orders for work. New machine tools were built, and the establishment was better fitted for heavy work than most others in the United States. The screw propeller had proved its adaptability and its superiority to all other means of marine propulsion, and orders for engines to be placed in freight barges and coasting steamers were received. Iron hulls were just coming into favor in America. Two had been made by James Cunningham, of New York, for service on the Raritan Canal and the Hudson River. Next in order was one called the "R. F. Loper," intended for use on the Dismal Swamp Canal. Its dimensions were (about) 80 feet long, 17 feet beam and 8 feet depth of hold. The frames were set up and the plating done in the yard of the Southwark Foundry, and the complete

hull, without the deck or joiner work, was transported to the river in the same way as described in the matter of boilers for the "Mississippi," viz., common carts. The launching was effected by sliding the hull sideways upon timbers projecting beyond the wharf, until clear of it, when the entire matter was permitted to drop two feet or so into the water. Thus began the grand fleet of iron vessels built on the Delaware at Wilmington, Chester, Raigns Point and Philadelphia. One humorous (to the spectators) incident occurred at this launch. It had been forgotten by those in charge, that a laborer had been put on board, while the boat was on the ways, to clean out the bilges and limber holes; and when the boat was shoved out and dropped, he went too. When the water was struck, a loud yell was heard, followed by the exclamation: "Holy Saint Peter, save me!" No bones were broken.

The notebook of the "assistant" contains the table giving the breadths of beam at each water line, rising of sheer and other data used in laying down the lines of this hull on the mold board. The proper manner of doing this was imparted to the junior boss and the "assistant" by Mr. John Lenthall, naval constructor at the Philadelphia Navy Yard at that time, and who had become intimately acquainted with the bosses during the building of hulls for the "Mississippi" and the "Princeton."



EARLY TWIN SCREW ENGINES.

It was natural that iron-boat building should have begun in machine shops, for only in such establishments were to be found the workmen, as smiths and plate-iron workers, and the tools most nearly suited to that industry—but, of course, inexpert. For example, a heavy wooden template of each frame was made and used by the smiths to give form to the frames (bars of $\frac{3}{8}$ inch x $2\frac{1}{2}$ inches), which had been heated in an open fire, portion by portion, and bent on the anvil; and the plating, especially at entrance and run, was accomplished by boiler-makers using the rule of "cut, bend and try." Rather primitive, but nevertheless "we got there." The "R. F. Loper" was fitted with an oscillating engine which had the piston rod passing through both cylinder heads and taking hold of pins in the crank wheels of propeller shafts. This machine did not work well and was supplanted (see sketches) by one of Captain Ericsson's design—a single upright cylinder with a crosshead standing athwartships, and two connecting rods, diverging, and taking hold of crank pins in gear wheels keyed to propeller shafts. Two idler intermediate gear wheels were introduced to insure parallelism of crosshead and uniformity of revolution. This type of engine (a modification of Cartwright's) gave excellent results, and many were built during the period in which two propellers were deemed essential; but it soon became evident that one propeller could be made as efficient as two, and so a simpler engine, occupying much less space, came into use. Its type is now to be found on the smallest tugboats, and on the largest ocean steamers and war vessels. It was original, I believe, with the firm of J. & G. Thompson, of Glasgow, who placed one on the steamer "Frankfort."

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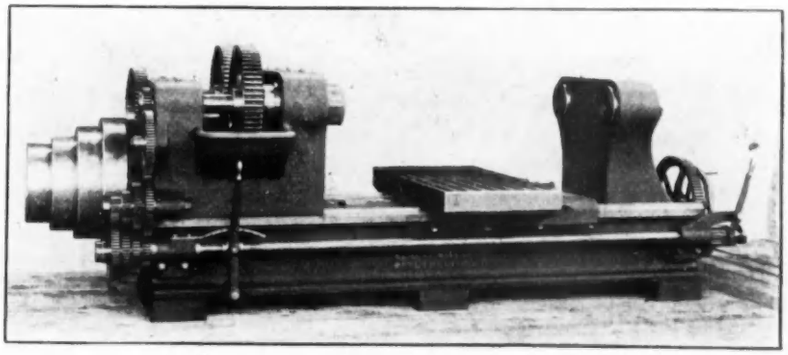
Double Cylinder Boring Machine.

This machine is designed especially for rapidly boring two cylinders at once, and is particularly useful in works where a large number of cylinders of the same or nearly the same size are to be bored. The machine is usually made with a bed $11\frac{1}{2}$ feet long, fitted with a head-stock carrying two heavy spindles 5 to 9 inches in diameter, with bearings adjustable for wear, placed with their centers 31 inches apart horizontally. These spindles are driven by a 30-inch cone pulley with four steps for 5-inch belt, geared in a ratio of fifteen to one. The boring bars are inserted in these spindles, and have their outer ends supported in a double tail-stock fitted with removable bushings and adjustable upon the bed.

The work table is 66 x 42 inches, which dimensions, however, can be varied when required. The table is traversed by hand or power 45 inches upon the bed. It has four automatic feeds from $\frac{1}{32}$ to $\frac{1}{4}$ of an inch. These feeds can be changed to any desired figures, and the bed can be lengthened or shortened, within reasonable limits, to suit requirements. From the top of the table to the center of the spindle is 19 inches, and the bed is 5 inches below the top of the table.



DOUBLE CYLINDER BORING MACHINE

The total swing over the bed is 48 inches, and over the table 38 inches.

This special machine has been designed by Messrs. Bement, Miles & Company, of Philadelphia. One of these machines has lately been installed in shops where they are manufacturing air compressors, rock drills and similar work, and it has proven in this connection very efficient and satisfactory.

Somewhat similar machines have been used very successfully for boring the cylinders of duplex pumps, and are sometimes arranged so that the center to center distance of the bars can be altered.

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The Otto Gas Engine.

Editor American Machinist:

I wish to make a correction in the article published in the issue of the "American Machinist" of April 16th, in regard to the new gasoline marine engine built by the Otto Gas Engine Works. In the last paragraph it states that Fig. 3 gives an idea of the smaller single-cylinder yacht engine, which is made in sizes from 2 up to 17 horse-power, etc. The cut shown is a double-cylinder engine of 17 horse-power, and is the smallest of the double-cylinder type. The sizes from 2 to 12 actual horse-power, inclusive, are single-cylinder, and from 17 up of double-cylinder. A cut of a single-cylinder engine is not shown.

J. J. CHAPIN,
Mgr. Marine Dept., Otto Gas Eng. W'ks.

ELECTRICAL MACHINERY.

The Building of a Great Dynamo—V.

When the winding is complete, the insulated armature ring of iron segments and paper insulation segments, and its insulating covering, is wholly hidden by the commutator and U-bars, which finally form a single continuous copper bar wound in an endless spiral around the armature ring. A very great amount of hand labor of the most painstaking character is involved in these winding operations, and it is none of it routine work. It might be said that the whole of the winding of the armature ring is simply done the best way the hands can find to do it. The conditions vary constantly in placing the commutator and U-bars, and every step calls for experience, close attention and quick thinking to make use of such various wedging and clamping devices as will best meet the situation.

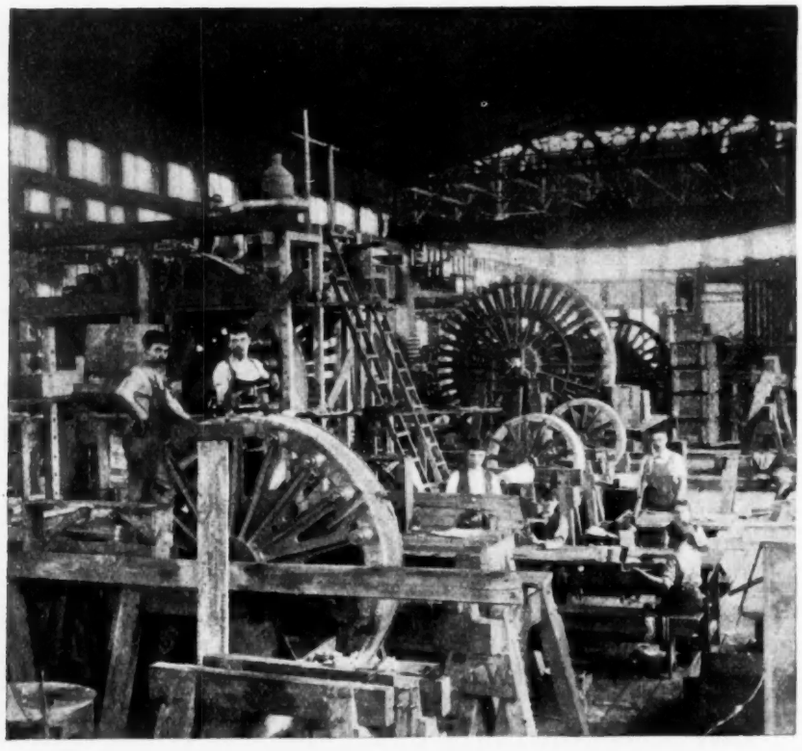

Fig. 19. ARMATURE FLOOR—GENERAL VIEW.

Fig. 19 gives as good an idea of the general appearance of the Siemens-Halske winding floor as can be conveyed with so small a picture. The two hands in the left foreground are soldering the U-bars into the commutator bars, the ends of both being tinned before assembling. Fig. 20 is a larger scale picture of this soldering operation. Before soldering, the U-bars are drawn up tightly against the inside of the armature ring, and the commutator bars are at the same time forced down hard on the outside of the ring. The tools used to draw the bars tight are a crayon-holder clamp composed of two loose steel gripping jaws at the ends of short steel bars, and a square block or "ring" to slide down on these jaws while they embrace the projecting upper ends of a U-bar as far as the "ring" will go, and then be driven down hard with a hand hammer, so that the crayon-holder clamp jaws bite the ends of the U-bars hard. Then a forked wedge with a cleft wide enough to straddle the U-bar end has its cleft point driven between the bottom end of the crayon-holder clamp jaws and the top of the commutator bar, and this fork wedge is driven up with a hand hammer and pulls the U-bar up tight, forcing the commutator down hard at the same time. When the bars are thus tightened on the armature ring, large U-clamps are placed to bear on each end of both the U-bar and commutator bar, which are wedged together, and the clamp screws are turned down hard so as to hold what the fork wedge has got, and then the surplus split top ends *E*, Fig. 15 *A*, of the U-bars are chipped off with a sharp thin chisel, applied as shown in Fig. 15 *A*. This turns the hook on the bar end, as previously described, and holds the two bars together while they are soldered tight to each other with a big copper, as shown at the right of Fig. 20. Four workmen are used in a gang for this operation; the one who should stand in the right foreground is out. The hands of one are shown holding the iron porter bar of the big soldering copper, and one hand of the second man is shown holding a strip of solder up against the copper so that it can melt and run down and fill the bar joint full, and one hand of the third workman is shown at the left, holding the split wedge under the bar-end clamp. This view also shows very clearly how the U-bars pass the armature-ring supporting bolts. The wedging and drawing up sidewise, and wedging and drawing up with the forked wedge, are constantly in progress; and the big soldering coppers, heated in big charcoal pots, are in use pretty much all the time. There is plenty

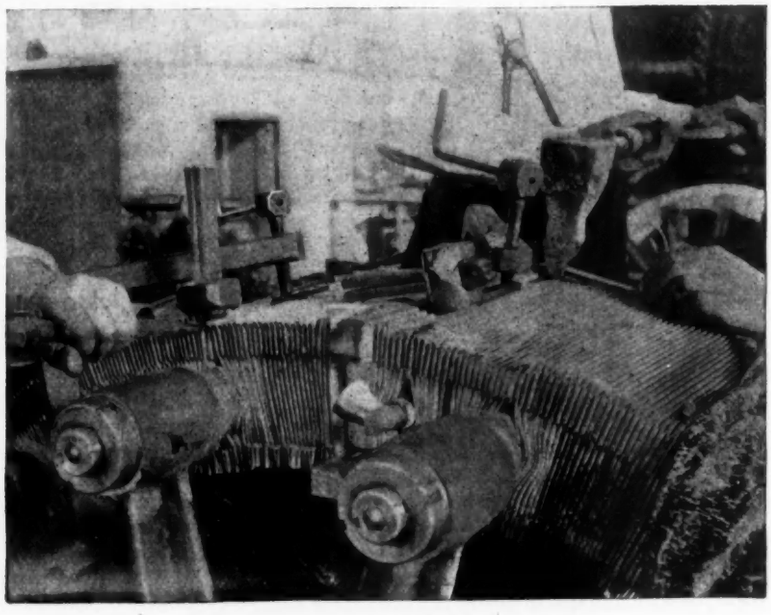

Fig. 20. SECURING COMMUTATOR BARS.

of soldering acid floating in the surrounding atmosphere, and this job is just good hard, careful work every minute. One of the crayon-holder clamps is shown in Fig. 20, lying idle on top of the bars, just in front of the U-clamp. This is a tool not often used in the machine shop; it has a bull-dog grip, and should be borne in mind for use under unusual conditions.

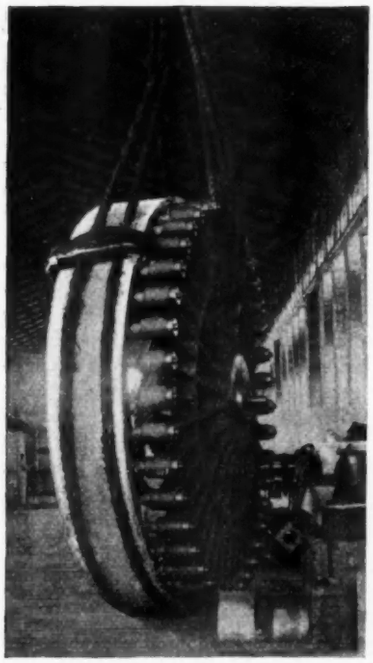

Fig. 21. ON THE WAY TO THE LATHE.

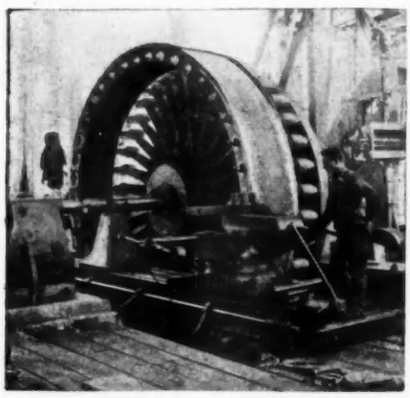

Fig. 22. IN THE LATHE—FRONT SIDE.

After all the copper is in place, the ends of the commutator bars do not stand quite even with each other on the sides of the ring; and to make all this smooth and even without touching the metal, a wooden mold, plaster of Paris and a trowel are brought into use to lay a substantial square section rim or flange of plaster on each side of the ring, on the commutator bar ends. This is laid on heavy enough to finish in the lathe, so that the outside edges of the finished armature ring will run true when put at work. This is the final operation on the armature in the winding room; and Fig. 21 shows how the great ring, now weighing about 42,000 pounds, is put in the slings for transportation by the traveling crane to the lathe where the face and edges are to be turned. A double sling is passed around the ring itself, and a heavy double of the same hawser is passed around one of the star arms, under the brace ring, and the crane hook takes hold of the loop on top so that the strain of the lift is evenly taken on both the ring and the "star." The ring was let down so as to just touch the floor, to steady it while the picture was taken. The plaster work on the sides of the rim and the manner of slinging are clearly shown.

Figs. 22 and 23 give back and front views of this expensive piece in the lathe, where the face and edges are turned with great care. The arbor is supported in an independent bearing in front of the tail-stock, and I think it is supported in a bored cup on the face plate, so that the tail-center only is used, and that merely keeps the job in place endwise. The whole job is so very truly put up that a very light cut only is needed to finish the outside, and the great ring of copper presents a very fine appearance when it has had the final very light finishing cut over it. The speed is slow, and all cuts are made dry, of course, as this armature ring is not a job to stand water.

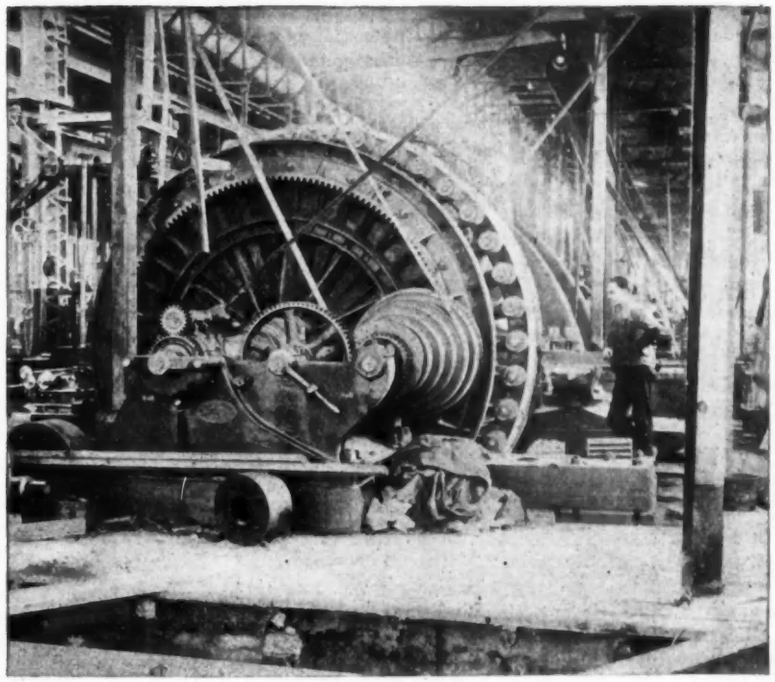

Fig. 23. IN THE LATHE—REAR.

After it leaves the lathe the plaster finish on the ends of the bars is painted black, and the "star" has the finishing touches from the hands of the painter and varnisher, and one big anxiously watched piece of this big dynamo is done.

H. L. A.

The Annual Report of the General Electric Co.

This report gives a striking illustration of the extent of the electrical business in this country:

The daily average of orders received during the year was 350. The sales for the year comprised nearly 12,000 complete machines, having a total capacity of 500,000 horse-power. These figures include nearly 9,000 street-car motors, and over 90,000 horse-power of railway generators. The sales of incandescent lamps reached nearly 6,000,000. Thirty generators of 1,000 horse-power or over were made during the year, or were on order February 1st.

Sixty thousand horse-power of apparatus for the conversion of water-power into electricity were supplied during the year. One of these involved the transmission of 4,000 horse-power 24 miles; another, 1,400 horse-power 35 miles; another, 1,800 horse-power 14 miles; and another, 2,350 horse-power 23 miles.

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Mechanical and Electrical Work and Power.

The meaning of electrical work and power can best be understood from their analogy with mechanical work and power. Mechanical work is expended in driving a dynamo and, less the losses of transmission, its equivalent must appear in the current generated, just as an equivalent of the work done in driving a fire engine, less the transmission losses, must appear in the current of water spurting from the nozzle.

Mechanical work is the product of two factors—force and motion. If a load of ten pounds be lifted a distance of ten feet, one hundred foot-pounds of work will have been done; or if a small pump plunger having a total load of ten pounds against it be given a number of working strokes aggregating ten feet in all, the same amount of work will be done. The element of time does not enter into work. The ten pounds may be lifted the ten feet in a second, a minute or an hour, and the work done will in all cases be the same. The work done divided by the time in which it is done, gives the work done per unit of time or the power consumed. A small engine will lift as heavy a load as a large one if it be geared back more—or in other words, if the load be raised more slowly and the engine given more time to do the work. If the work done per minute equal thirty-three thousand foot-pounds it is called a horse-power. To find the power then, we multiply the number of pounds of force by the number of feet of motion, and divide the product by the number of minutes or seconds of time consumed, the result being the power in foot-pounds per minute or second, according as minutes or seconds have been used. It is however, immaterial whether we multiply the pounds of force by the feet of motion and then divide by the minutes of time, or whether we first divide the feet of motion by the minutes of time and then multiply the quotient by the pounds of force. That is,

$$\frac{\text{force} \times \text{motion}}{\text{time}} \text{ is the same as}$$

$$\frac{\text{motion}}{\text{time}} \times \text{force.}$$

The total feet of motion divided by the minutes of time in which the motion is made, gives the motion per minute, or the velocity, and we may therefore say that the power consumed is the product of force and velocity.

Another way of looking at work and power, which is more closely parallel with electric power, is to consider the pumping of water. If we have a pump plunger of one square foot area loaded with ten pounds pressure per square inch, the total load will obviously be 1,440 pounds. If this plunger have ten feet stroke and it be moved against the pressure one stroke, the work done will obviously be $1,440 \times 10 = 14,400$ foot-pounds. Now, a plunger of one foot area making a stroke of ten feet will displace ten cubic feet of water per stroke, and our 14,400 foot-pounds of work could have been obtained by multiplying the pressure per square foot by the cubic feet of water pumped.

The two methods of procedure look very much alike in this case, for the reason that the area of the plunger was taken at a square foot, which results in the number of feet of stroke and the number of cubic feet of water pumped being the same. Had the pump plunger been of any other size the figures would have been different in the two calculations, though the results would have been identical. Thus, if the pump plunger had had an area of one-half a square foot and the stroke had been twenty feet, the pressure per square inch being 10 pounds as before, the total pressure on the plunger would have been 720 pounds and the work per stroke would have been $720 \times 20 = 14,400$ foot-pounds as before. The pressure per square foot would, however, still have been 1,440 pounds, and the number of cubic feet pumped per stroke 10, and, using the second method of finding the work, the figures would be, as before, $1,440 \times 10 = 14,400$. From this it will be seen that the second method is entirely independent of the size of the pump, and concerns itself only with the pressure and volume of water. If the size of the pump were unknown, the amount of work done could be calculated with the same certainty from the pressure and volume of water. Thus, if 75 cubic feet be pumped against 600 pounds per square foot, the work will be $75 \times 600 = 45,000$ foot-pounds, regardless of the size of the pump.

If this work were done in two minutes the power would be

$$\frac{75 \times 600}{2} = \frac{45000}{2} = 22500 \text{ ft.-lbs. per min.,}$$

$$\text{or } \frac{22500}{33000} = .683 \text{ horse-power.}$$

Now, as before, it makes no difference whether we multiply the pressure per cubic foot by the cubic feet pumped and divide the result by the time, or whether we first divide the cubic feet by the time and so get the cubic feet per minute, and then multiply that by the pressure per square foot. That is,

$$\frac{75 \times 600}{2} \text{ is the same as}$$

$$\frac{75}{2} \times 600$$

We may say, then, that the power exerted by the pump is equal to the cubic feet pumped per minute multiplied by the pressure per square foot.

Now, this method of determining the power of a pump is strictly analogous to the method of finding the power of an electric generator. The volt is equivalent to pressure per square foot, and the coulomb is equivalent to the cubic foot of water. A dynamo which moves ten coulombs under a pressure of ten volts, does one hundred volt-coulombs of electrical work, precisely analogous to ten cubic feet of water against ten pounds per square foot, or one hundred foot-pounds of mechanical work. With water we have no abbreviated expression for a cubic foot per minute, but in electricity we have, except that in electricity the second is always used instead of the minute. Instead of saying one coulomb per second, we say one ampere, which means the same thing. Now, precisely as the power of the pump was found to be the product of the pressure per square foot by the cubic feet per minute, so the electrical power of the generator is the product of the volts of pressure by the coulombs per second; that is, the volts by the amperes.

With mechanical power we have no single word to express the pumping of a cubic foot per minute or second against a pressure of one pound per square foot, but in electricity we have. In mechanics we must say in full, one cubic foot per minute against a pressure of one pound per square foot; but in electricity, instead of saying one coulomb per second against one volt, or even one ampere against one volt, we say one watt. In electricity, then, we have two words for whose parallels in mechanics we must use phrases—namely, the ampere, analogous to one cubic foot per second; and the watt, analogous to one cubic foot per second pumped against one pound per square foot. Now, just as thirty-three thousand foot-pounds per minute is equal to a mechanical horse-power, so 746 watts is equal to an electrical horse-power, and the one is equal to the other; by which is meant that a dynamo consuming one horse-power and working without loss would deliver 746 watts of electric power, or a motor consuming 746 watts of electric power and working without loss would deliver one mechanical horse-power. This mechanical horse-power might be made up of a belt pull of one pound traveling thirty-three thousand feet per minute, or of a pull of thirty-three thousand pounds traveling one foot per minute; and just so the electrical horse-power might be made up of one ampere under a pressure of 746 volts, or of 746 amperes under a pressure of one volt, or of any other combination of volts and amperes whose product should equal 746. The watt is, however, a small unit. To use it in connection with modern dynamos would be equivalent to measuring the distance between New York and Chicago in feet; and just as we need the mile to measure large distances, so we need a large electrical unit for large amounts of electrical power. Such a unit is the kilowatt, which is equal to one thousand watts, and is equivalent to

$$\frac{1000}{746} = 1.34 \text{ horse-power.}$$

A discussion of this sort is of necessity somewhat dry; but a clear understanding of it is essential to anyone who wishes to clearly understand electrical terms, or the action of electrical machinery.

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Letters from Practical Men.

Raising Prices of Machinery.

Editor American Machinist:

Your article in issue of 16th, on "Who Should Raise Prices of Machinery," is one of much interest at the present time; but it would probably have been even more interesting if you could have given the name of the party who dominates prices in his line, but who is waiting for a change of Administration to bring better prices,

while he evidently has it in his power to do much to bring about the desired result himself.

It is a singular fact that in many lines of manufacture the shops have all the work they can attend to but the proprietors all complain "that prices are off" and there is "no profit in doing business."

Who is at fault about these matters? are these extremely low prices of benefit to anyone, even the purchasers? and what can be done to improve prices all along the line? are questions of more than ordinary interest at present, and a discussion and exchange of views on them ought to make interesting reading.

I have given these questions some thought of late, and have concluded that if the prices at which orders are accepted, together with the names of the parties accepting them, were published, it might have a beneficial effect. This proposition might not be kindly received at first; but let us remember that in all government and corporation work of account, the bids under given specifications are matters of record and are accessible to the press and all interested parties after the bids are opened. Many of the trade papers publish these items, and it is possible they are among the most carefully read and preserved of any of the matter published.

Why, then, would it not be a good idea to secure and publish the figures in commercial cases after the contracts have been closed, the same as in government and corporation work? Would not the knowledge that our figures might be held up to the inspection of our competitors, as well as to the parties from whom we purchase our raw material, prevent us from submitting prices that all would know are not remunerative?

This question may be too large to handle in an article of this nature; but it is evident that prices are too low, and the question is—What are we going to do about it? Is not this something like the question of resuming specie payment after the close of our "late unpleasantness"? Who was it that said the way to resume specie payment was to resume? In like manner, is not the proper way to raise prices of machinery to raise prices?

W. H. ODELL.

Yonkers, N. Y.

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Mr. Allen's Problem No. 8.

Editor American Machinist:

Some solutions of Problem No. 8, already forwarded, have directed my attention to a slight error in its enunciation—probably a misprint. In the enunciation (page 7-279, fourth line from bottom of the middle column) the letter of reference should be E^1 instead of E.

However, the problem is essentially the same, whether either of the wheels, E or E^1, be made to move through twenty degrees while the other moves the last ten degrees of each quarter revolution; and this error need not, therefore, cause any confusion. During the eighty degrees of motion prior to the time when one of the wheels makes its gain of ten degrees, the wheels are to move with uniform and equal velocity. During the period wherein one gains upon the other, it does not matter whether the gaining wheel moves twice as fast as the other, or not, provided that, when the wheel that moves with uniform velocity through its entire quadrant of motion has made that movement, the other wheel shall have moved ten degrees more.

LEICESTER ALLEN.

▲ ▲ ▲

Power Calculations for a Traveling Crane.

Editor American Machinist:

I have read Mr. Griffin's article on the above subject with interest, and am glad to note that he confirms my own practice, but there is one point on which I do not quite agree with him:

In the beginning of his article he says that "resistances due to irregularities of the track are due to bad workmanship, and should be treated as incalculable factors." Now, such irregularities are sure to exist and cannot be entirely eliminated, and therefore allowance should be made for them. An allowance of 5 per cent. additional to the 10 per cent. for axle friction, I would not consider too much for cranes under ordinary circumstances; but I have known instances where the coefficient was even greater than this.

ALFRED DUNN.

Cleveland, O.

[Mr. Griffin's remark that such resistances "should be treated as incalculable factors" does not at all imply that he would make no allowance for them.—Ed.]

▲ ▲ ▲

The Vena Contracta and Bilge Strainers.

Editor American Machinist:

Since Mr. Harrison states that he knows by personal test that the "vena contracta" does not affect the entrance of water into an opening, but simply disports itself in the free fluid outside, there seems nothing further for me to say on the subject, except that I hope the startling fact will be brought to the attention of those scientific fellows who have been leading us astray for so long, that they may revise their text-books.

Also, thankful am I indeed that I live in an age when the engineers of sinking steamers consider it unprofessional to "lift the bilge strainers aside," and allow the pumps to clog and the ship to founder with all hands rather than to stand by with a broom and keep the debris clear of the strainer meshes.

J. G. SAYCE.

New York.

The Meaning of the Term "Ratio"—Cylindrical Inches.

Editor American Machinist:

"Superannuated," in your issue of April 16th, says that I give, in the "Mechanical Engineer's Pocket Book, "Ratio of diameter to circumference = reciprocal of π," while Mr. Mason states that π always means the ratio of the diameter to the circumference. In your editorial explanation of this discrepancy you say it is evident that in Mr. Mason's article the words "diameter" and "circumference" have been transposed. Mr. Mason may answer for himself, but I wish to call your attention to another possible explanation—it is that Mr. Mason and I may have used the word "ratio" with exactly opposite meanings.

In "Webster's Unabridged," edition of 1887, "ratio" is defined thus: "The relation which one quantity or magnitude has to another of the same kind, as expressed by the quotient of the second divided by the first; thus, the ratio of 3 to 6 is expressed by $\frac{6}{3}$ or 2, of a to b by $\frac{b}{a}$." In a note under this definition, Webster says: "Some writers, less properly, consider ratio as the quotient of the first quantity divided by the second."

In my "Pocket Book," page 5, I define "ratio" as follows: "Ratio is the relation of one number to another, as obtained by dividing one by the other." This is a definition that does not exactly define; but whether "one by the other" means the "first by the second" or "the second by the first" is clearly shown by the examples immediately under the definition—thus,

Ratio of 2 to 4, or $2 : 4 = 2 \div 4 = \frac{1}{2}$

Ratio of 4 to 2, or $4 : 2 = 2$

I am therefore in the class of writers to which Webster refers by the words "less properly." Mr. Mason he would consider entirely proper in his use of the word "ratio." I have a great admiration for Webster as a general thing, but think he was a little "off" in this particular definition. The definition I have given, when explained by the example, agrees with all that I have been taught on the subject during the last thirty years, and with what I believe to be the universal custom of engineering teachers at the present day.

The definition of "ratio" given by the "Century Dictionary" is rather muddy. It says: "The relation between two similar magnitudes in respect to quantity; the relation between two similar quantities in respect to how many times one makes so many times the other. . . . By mathematicians ratio is now considered and spoken of as synonymous with quotient." There is nothing here to show whether the ratio of 3 to 6 is the quotient of $6 \div 3$, as stated by Webster, or the quotient of $3 \div 6$, which is commonly used.

In re cylindrical inches, which "Superannuated" also discusses, I left them out

of the "Pocket Book," not thinking that anyone would want them; but his suggestion is a good one—they may some day be wanted. I have therefore written on the margin of the table on page 169—the weight per cylindrical inch, in decimals of a pound—the following figures for the materials named:

Cast iron	.2045
Wrought iron	.2182
Steel	.2225
Copper and bronze (copper and tin)	.2509
Brass, 65 copper, 35 zinc	.2378
Lead	.3225
Aluminum	.0757
Glass	.0743
Pine wood, dry	.0137

WM. KENT.

Passaic, N. J.

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Speed of Foot Presses—Girls as Kickers.

Editor American Machinist:

Referring to your issue of March 12th, I note with interest a description of "A New Split Die," in this case designed for use in a foot press. I have used various forms of split dies and foot presses, both in America and here in Germany, and am very much in favor of both for work within their range; but what interests me most in the article referred to is the girl who cuts off 150 to 200 pieces per minute of wire 6 to 10 inches long, feeding (presumably by hand) from the coil. If I may be permitted to indulge in the parlance of baseball, is that young lady's release for sale? I have been looking for just such a girl for a long time (not for a partner) to pose as a living example to other foot-press operators. Pardon a few figures: 150 to 200 per minute is 9,000 to 12,000 per hour, or 90,000 to 120,000 per day.

F. E. BRIGHT.

Berlin, Germany.

Editor American Machinist:

The doubting inquiry of Mr. Bright, regarding a statement in my article "A New Split Die," above all teaches me one thing—that is, "never to boil down an article so much that its true taste is lost."

The mathematical work of Mr. Bright might have been needless, had he given a proper definition to the words I used. I did not say a girl is able to cut 150 to 200 pieces "per minute," but 150 to 200 pieces "in a minute," thus making a minute the fixed time to test the strain to the die that a girl is able to put on. I agree with Mr. Bright as to the impossibility of a girl cutting from 90,000 to 120,000 pieces per day, even on such well-balanced presses as they are. The object of my article was not to treat of the physical strength of girls, but rather of the good features of my die.

Mr. Bright seems to have overlooked something. Did it occur to him how the wire that the girl receives in coils is unwound at such a cutting speed? Supposing it did not, permit me to explain this. The wire coils, about 18 inches in diameter or 56.5 inches circumference, are laid upon revolving stands mounted upon the bench; 200 pieces to be cut in a minute render 35.5 turns of the wire stand necessary. As no steam engines or electrical motors are attached to the stands, another operation enters the girl's day's work which occupies a considerable amount of time. It is to uncoil the wire and land it down upon the floor in heaps, from which the left hand of the operator feeds it into the press; the right hand picks up the cut-off pieces from the gage plate. Most naturally, I selected the two fastest kickers of the lot, who gave me my figures.

I invite Mr. Bright, on his next visit to New York, to convince himself by his own ocular view; but, not unlikely, his eyes may strike when looking at the movements of a girl press-kicker when bound to earn money.

FRANK HERLT.

New York.

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Calculating Machines Versus Logarithmic Tables.

Editor American Machinist:

I am glad to note the valuable article by such an authority as Coleman Sellers, upon the utility of the calculating machine as compared with logarithms, for there are many who consider logarithms as the easiest, most accurate and quickest method of working multiplication and division. This supposition may be true in certain isolated cases and for special formulæ, and it is certainly true for the extraction of roots; but for plain multiplication and division—the sort that comprises ninety-nine hundredths of practical calculation as it is—the machine will beat the book two to one as to time, and show a saving of errors and a gain in ease of mental operation.

To prove this statement, nothing is needed but actual test and comparison; but for those who have not the machine to test, there is nothing better in the way of a complete comparison than the report of the Chief of Engineers of the United States Army for 1882, for which see Appendix No. 1, page 2786. The report is too long to repeat here, but I will copy a few statements:

"Two computing machines have been used in the Lake Survey Office—the Thomas and the Grant.

"The relative rapidity of the two machines and logarithms is shown by the following results of actual trials. One hundred multiplications of seven figures by seven figures were made with each of the machines and with logarithms, only seven figures of the product being retained. The average time of a single multiplication was

With the Thomas machine.....Seconds.	69
With the Grant machine..... "	56
With a seven-place logarithmic table. "	157
Number of errors with the Thomas machine..	7
Number of errors with the Grant machine....	5
Number made with logarithmic tables.....	12

"One hundred multiplications of five figures by five figures were made, retaining only five figures in the product. The average time of a single multiplication was

With the Thomas machine.....Seconds.	34
With the Grant machine..... "	30
With logarithms ..... "	73
Number of errors with Thomas machine was.	4
Number of errors with Grant machine was...	5
Number of errors with logarithms was	9

"Two of the errors made with the Thomas machine were caused by defects in the discharging apparatus; the remainder were made by the computer.

"All the errors with the Grant machine were made by the computer.

"The preceding trials were made by eight persons and the mean taken. The result shows that multiplications of five figures or more can be done about two-and-a-half times faster with these machines than with logarithms, and with only one-half the number of errors."

In addition to this, the report is very decided in the opinion that the mechanical method is much the easiest.

In order to get a means of comparison I went through with an extensive series of multiplications, doing the same examples hundreds of times with the machine, with logarithms and by the usual mental method, and can say that the following table represents my average time by the three methods, the work being done leisurely, carefully and correctly, just as if it was regular work on which time was not being kept:

	Machine. Seconds.	Mental. Seconds.	Logarithms. Seconds.
2 figures multiplied by 2	10 to 13	10 to 16	40 to 45
3 " "	3..14 to 18	26 to 30	51 to 57
4 " "	4..17 to 22	40 to 45	56 to 61
5 " "	5..19 to 28	62 to 75	65 to 72

Of course, such a result as this depends on personal ability, and would vary with different persons; but I believe the figures given are a fair average.

The Burckhardt machine, spoken of by Mr. Sellers, is the same as the Thomas machine—literally a copy of it. The Thomas is of French and the Burckhardt of German manufacture. The Grant is an American machine. All the machines in use are practically the same as to rapidity, ease and accuracy of operation, and differ only as to size, complication, delicacy, etc.; so that the contest is not as between one machine or another, but as between mechanical calculation and logarithmic calculation. The latter has the advantage of age, established reputation and first cost of apparatus; but is far behind with respect to the important items of time, ease and accuracy.

GEORGE B. GRANT.

Lexington, Mass.

Wax for Holding Work on Grinder —A Milling-Machine Difficulty.

Editor American Machinist:

Most every mechanic knows the difficulty of holding small pieces, without seriously springing them, while being machined. The ordinary machine vise is all right for work that is large enough to have some strength, but even then great care must be taken in order to work the sides parallel, or two sides square, as the case may be.

At the factory where I am at present, there is a large quantity of small work, and of great variety, ground on Brown & Sharpe surface grinders, and as it is nearly all hardened, and therefore somewhat crooked, when it comes to the machines, there was considerable difficulty in holding it without having a side or place that

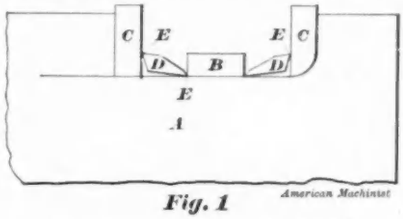

Fig. 1

ONE WAY OF HOLDING WORK.

was ground spring all out of shape as soon as the clamps that held it were released. That, of course, made it necessary to frequently change from one side to the other, and raised the cost in proportion.

Some time ago it occurred to me to lay the work down on the platen, perfectly free, and then pour hot wax around it; and after several trials to find the proper wax, it was generally adopted. For winter we use about three parts of common beeswax to two parts of rosin. It will be necessary to use a slightly greater proportion of rosin for summer.

This wax is used almost entirely for grinding parallel work. It holds very

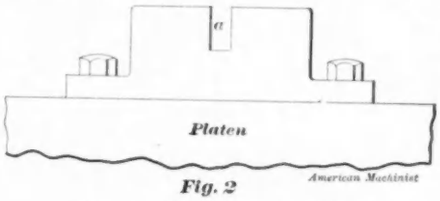

Fig. 2

BLOCK FOR HOLDING WORK.

firmly, the work rarely if ever coming loose; and as benzine cuts the wax off from the pieces after they come from the machine, and from the machine platen, it is very little trouble. A pan of benzine is kept at hand to soak the pieces in. The wax will also hold work sufficiently strong on a planing machine or lathe face plate if the cuts are light, and it has the advantage of turning out the work as true as the machine itself, and not depending on vises or fixtures which may not be in the best shape.

Work may be held very well and with good results as shown in Fig. 1, in which *A* is the vise and *B* the work which is held between the jaws *C C* by the strips or ribs *D D*, bearing at the points *E E E E* and tending to hold the work firmly on the base of vise or fixture. This method has been in use a good many years; but the wax has the advantage of a clear surface over the work, however thin it may be, which prevents any liability of running the tool or emery wheel into the holding device.

Another very important point is that, when there are a number of pieces to be worked all alike, they may all be put on the platen at the same time, or at least it may be covered with the pieces with only a small space between for wax. It is only necessary to take one off occasionally to caliper, and it may be put back again without trouble. Oftentimes the work is of such nature that it may be put over a T-slot, and so may be measured without removing it from its place. We frequently use a block, Fig. 2, to hold the work, which also admits of measurements without removing the work from its place, the slot *a* being large enough to admit the base or anvil of a micrometer caliper.

I am well aware that the wax method has long been used by instrument makers

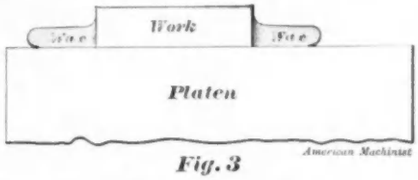

Fig. 3

HOLDING WORK BY WAX.

on the face plates of small lathes, but think its application to the grinding machine is new.

A convenient thing for holding the wax and heating it in, is an ordinary pressed-tin cup with a spout put in the side. A piece of cotton string laid in the V of the spout, and hanging outside about ¼-inch will prevent the wax from running down the outside of the cup, and will enable the operator to direct the drops in exactly the right spot. If the cup is held about 3 inches above the work, the wax will come up pretty high at the edge where it falls, as shown at Fig. 3, and is best where the size of the work will admit; but for very thin pieces the cup must be held up 12 or 14 inches, when the wax will flatten out as it strikes the platen, and will not stand up above the work and have to be pared down, as it would if the cup were not so held. An ordinary gas jet burning up about ½-inch will keep the wax at about the proper temperature all the time.

We all know the difficulty of putting the dividing head on the platen of a universal milling machine. The end of the T-slot that the bolts must enter, and the traversing handles, are just near enough together to conspire for bruised fingers and ——.

After hearing many loud and earnest invocations go up from the vicinity of the milling machine, I hit upon the way of

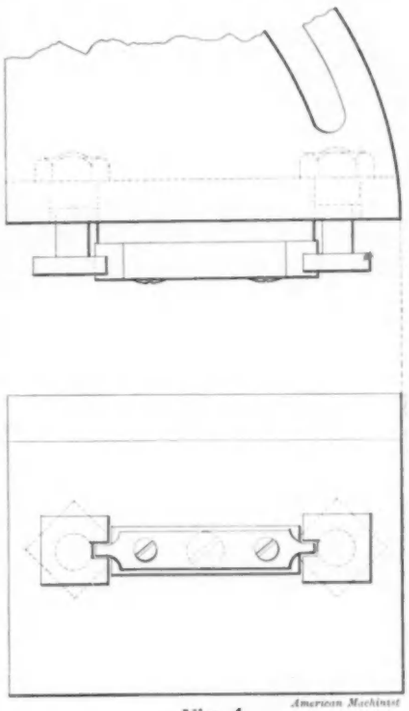

Fig. 4

A MILLING-MACHINE KINK.

stopping it as shown at Fig. 4. The whole trouble is caused by bolt heads turning around and refusing to enter. Why the makers of the machines do not provide some way to prevent the bolts from turning I do not know, but the device shown, or something similar, will repay its cost in a very short time.

THEO.

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Fastening Piston Rods.

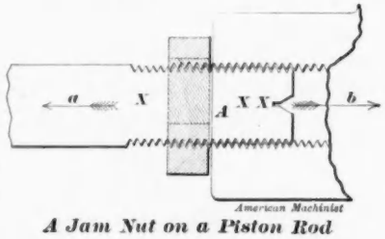
Editor American Machinist:

Mr. Swift does not like my method of holding a piston rod in its crosshead. I did not expect it would suit those satisfied with the jam nut, or those who lack confidence in getting a length just right so as not to need any leeway. Designers of very many large engines do not find it necessary to provide for any such adjustments, and solidly secure their rods in taper holes by driven or screw-drawn keys. It might have added strength and respect to my statement about there being but one correct length of a rod, by putting the same in quotation marks and using the name of the late George H. Corliss as the author, as he was certainly the man whom I well remember as making the remark to myself.

Mentioning another and very good way of holding a rod in place, by split cross-

head and tightening bolts, does not excuse or lessen the faults of the one under discussion. There are engines under my charge where the rods are held in place by clamp bolts, and in one case correctly; that is, the end of the rod enlarged so that the cross-section at the bottom of the threads equals the full size of the rod back of it.

Mr. Swift correctly quotes my statement as to the nut putting a strain "in addition to," etc., onto the rod, and then says this is not so. Let us see about that. Fig. 1 may represent a rod, jam nut and end of crosshead. Mr. Swift agrees that the weakest point is at the bottom of the thread, and the very particular thread and place must be at the dotted line *A*. He also says that a greater strain must be put on by the nut than is ever expected from the working pressure of the engine. Now we will suppose that the greatest strain ever to be expected from the pull of the piston is 10,000 pounds, and that the nut is screwed up to such a point that the tension is 10,500 pounds at the point *A*. The engine is at rest, and there is this tension of 10,500 pounds between the points *x* and *x x*. Now, in the direction of arrow *a*, at a certain and known distance, there is a piston, and in the direction of arrow *b* a crank pin. The pressure on the piston and the resistance of the crank are equal, or 10,000 pounds. If this is admitted, I should like to be informed if it is not "in



A Jam Nut on a Piston Rod

addition, aggravation," etc., of the strain previously existing at the point *A*.

In answer to the other criticisms, I will say that the rod was reduced for several reasons: First, 1⅝ inches was amply large for what was wanted. Second, the shoulder was desirable as a length limit and to carry the thrust; and as the exact length wanted was known, no adjustment was needed. Third, the rod was screwed solidly up to the shoulder, and I did not think any remedy necessary to prevent it going any further. It *is* something of an objection to lose a center; but if it ever becomes necessary to use one, I hope there will be skill and ingenuity available to solve the problem.

There is no mystery about the matter, or any difficulty about the taper plug holding the rod in place, even if its pressure is diffused over a greater periphery. The rod is screwed solid up to its shoulder; the taper plug expands the end of the rod so that it cannot turn; it is as solid as if cast there—no plaster-of-paris.

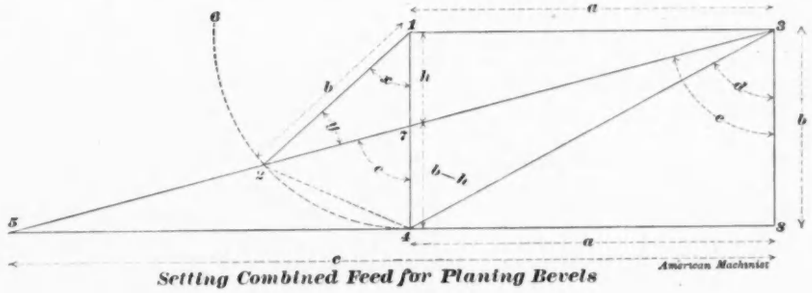
PETER H. BULLOCK.

A Kink in Bevel Planing.

Editor American Machinist:

I sometimes make use of a kink in machine-shop practice that I think is new to many and may be useful to some:

To plane a wide surface at a small angle from the horizontal, on a planer where it would be impossible to reach it with the angular feed alone, I use both the cross-feed and the down or angular feed, both feeds being geared together. If the down-feed is vertical, or 90 degrees, with



Setting Combined Feed for Planing Bevels

the down and cross feeds geared together, the angle faced would be 3 — 4 (*d*); but if the angle (*e*) 3 — 5 is required, the down-feed will have to be on the angle 1 — 2, (or *x*). The simplest way to find this angle is to lay it off on paper with dividers; construct a rectangle with the side *a* equal to the distance of cross-feed, and side *b* equal to down-feed. Draw 3 — 5, or angle to be planed (*e*); then with dividers, from 1 as center and radius *b*, draw circle 4 — 6. Then line 1 — 2 drawn from point of intersection of circle with line 5 — 3, will give angle to set the angular head of feed at. For if the cross-feed only is used, the tool, starting from 3, moves to 1; if the vertical down-fed is geared to it, the tool moves on the line 3—4; while if the down-feed is on the angle *x*, the tool, starting from 3, moves on the line 3—5.

This compound-feed method is also applicable to lathes with compound rest feeds for turning and boring tapers.

L. ANDREWS.

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Association of American Draftsmen.

The following is a circular issued by the association named below:

"The object of the Association of American Draftsmen is to promote and encourage a closer union of fellowship of the American draftsmen in government and private employ, and to discourage the employment of foreign to the detriment of American talent. Statistics germane to this object to be collected, and an eye kept on the various infringements and violations of the alien and civil service laws. A directory in which are placed the names of the members with their special business qualifications is kept, so that when a member loses his position the secretary, being notified, may in turn notify the members to keep a lookout for a vacancy suitable to special department of the member desiring employment.

"The association consists of active and honorary members. The active members being draftsmen or those whose duties associate them professionally with draftsmen, and the honorary members such persons upon whom the association may see fit to confer honorary distinction, who are entitled to all the privileges of active members except the right to vote and hold office. Unanimous consent being necessary to the election of the latter, and three negative votes rejecting an applicant for membership.

"All applications for membership must be sent to the secretary of the association, and considered by the council at least one week before being submitted for action at the meetings of the association, which are held quarterly.

"None but citizens of the United States are eligible to membership. American citizens of foreign birth must reside in the United States ten (10) years previous to application for membership. All applicants must be recommended by three (3) active members of the association, and be thoroughly identified as being in sympathy with the object of the association. The initiation fee, which must accompany the application for membership, is one dollar ($1), and the annual dues, payable in advance on the first day of January, are also one dollar ($1), except in the case of members of chapters, where the dues are as determined by a two-thirds vote of the membership of such chapter. The officers of the association consist of a president, three (3) vice-presidents, secretary, assistant secretary and treasurer, elected annually, who, with the representatives from the chapters (each chapter is entitled to one (1) representative and two (2) representatives-at-large), form the council, with headquarters at Washington, D. C. The duties of the council are to exercise a general superintendence over the affairs of the association, to control and manage its property, to make contracts and purchases, to authorize the formation of chapters, and to arbitrate and settle inter-professional disputes among members of the association should any arise. Chapters may be organized in any city where ten (10) members of the association reside, subject to the limitations of the constitution.

"For further information, address the Secretary of the Association of American Draftsmen, Washington, D. C.

W. T. JONES, Secretary.

"Bureau of Construc. & Repair, Navy Dept."

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Triple-Expansion Engine for Direct-Connected Electric Generator.

We present herewith an illustration of a recent addition to the equipment of the Third District Station of the Edison Electric Illuminating Co., of Brooklyn. With this we give line drawings, diagrams and indicator cards, showing some of the more interesting points of the engine.

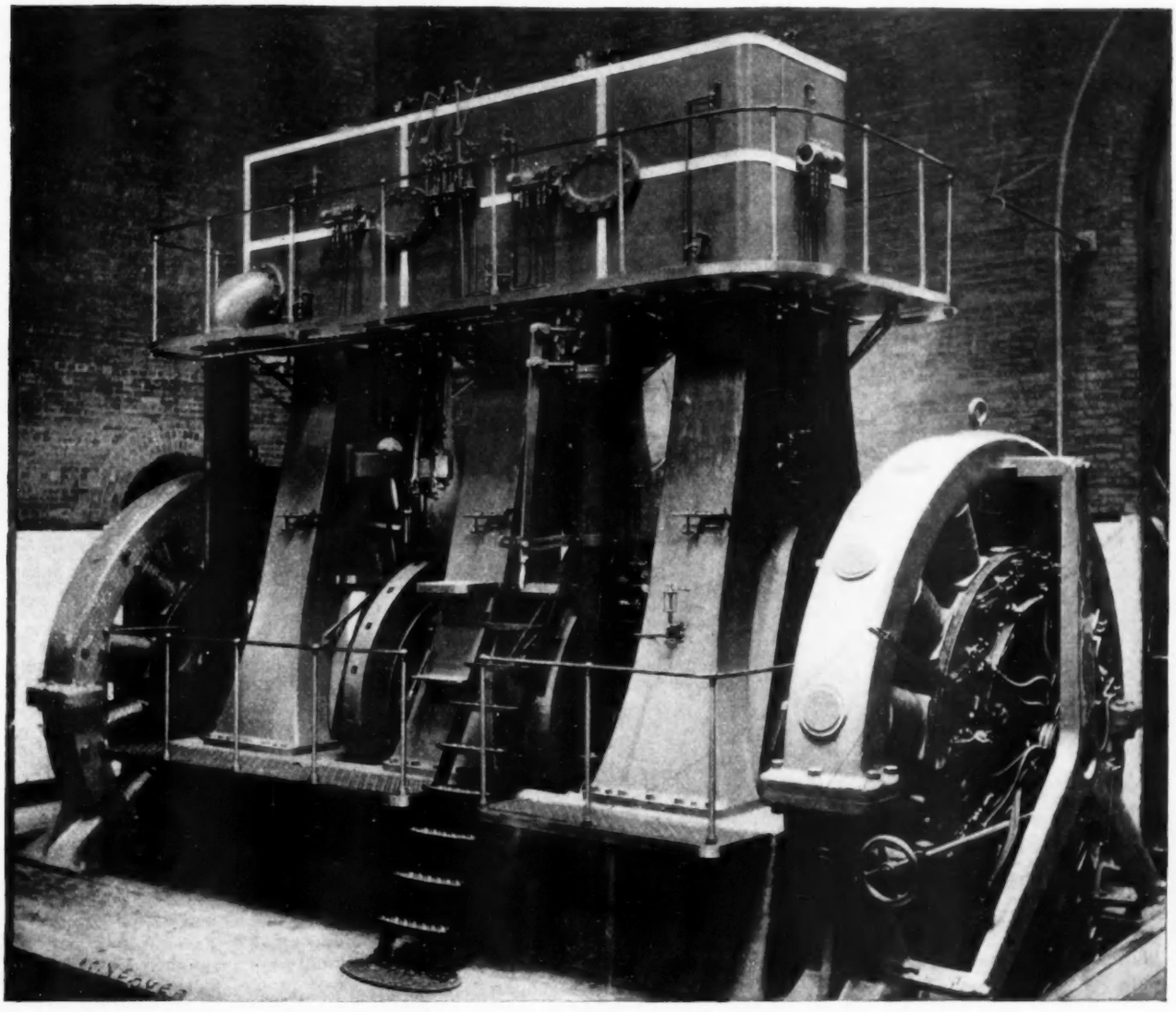


Fig. 1. TRIPLE-EXPANSION ENGINE AND DIRECT-CONNECTED ELECTRIC GENERATOR.

The general arrangement will be apparent from the main illustration, Fig. 1, which is from a photograph of the machine in position. The engine is of the vertical marine type, many of the details being also modeled after marine practice. To many who have been accustomed to the miscellaneous assortment of curves which are prevalent on the main-frame columns of engines of this type, the pattern of column here shown will be a welcome sight, as indicating progress toward the fundamentally right in machine construction. The strain lines of these columns are practically straight, with a proper spread at the base, and a thickening at the center to increase the lateral stiffness against the side thrust of the connecting rods. These frames are as satisfactory to the eye as they are to the judgment, and enforce anew that old epigrammatic dictum of Professor Sweet's, that to the truly educated eye what is right looks right.

The cylinders are triple-expansion, the diameters being 14½, 23 and 37½ inches, respectively; the stroke common to all being 28 inches.

The high and intermediate pressure cylinders are fitted with piston valves—the former with one and the latter with two of the same diameter, namely, 8 inches. The low-pressure cylinder has unbalanced multi-ported valves—separate for steam and exhaust and separate for each end.

The piston valves have new features in their packing rings, designed to prevent live steam from entering the annular space behind them, and so forcing them outward with undue and varying pressure against the seats. At the same time, provision is made for insuring that the port pressure shall enter behind the rings, and thus insure equality of pressure on both sides. The construction by which these features are obtained is shown in Fig. 2, which illustrates the valve for the upper end of the cylinder—the lower end being joined to this one by the rod shown—the valves giving steam by their inner edges. The valve will be observed to be in halves, thereby permitting the faces of the groove for the rings, as well as the faces of the rings, to be scraped to a joint without undue looseness. The two small rings are the packing rings, the broad central ring being an uncut or bull ring. The expansion of the packing rings is by their

own elasticity. At several points around the circumference of the bull ring, pockets, of which one is shown at *a*, are cut. In these pockets strong steel springs are inserted, in order to force the rings apart and insure a steam-tight joint at *b*. This joint prevents the entrance of live steam behind the rings; but this effort of the springs opens the joint at *c*, and the central ring, not being a packing ring, permits the port to communicate freely with the space behind the rings, and so establish port pressure there. At the position of valve shown, this pressure would force the lower ring outward, as the pressure behind the ring would be greater than that established in front of the ring by the seepage past it. To prevent this pressure from so forcing the ring outward, the friction of the ring against the edge of the groove is depended on, and experiments show that this action really takes place. With weak springs in the pockets *a*, the valve will offer a heavy resistance to motion, and even groan when moved; but as the strength of the springs is increased, the valve moves easier, until when the proper strength is reached the valve moves easily and freely.

The high pressure valve is actuated by an eccentric and shaft governor of the usual type, without special features of novelty. This governor attached to the high-pressure valves does all the governing—the intermediate and low-pressure cylinders having fixed cut-offs. The designer of this engine is fixed in his belief that this is the only correct method of using steam in a compound engine—the valves of the second and third cylinders having their cut-off so set that the volume of each cylinder at cut-off is equal to that of the previous cylinder at release. This relation is fixed with the design of the engine, and does not change with the load. In addition to this, the governor attached to the high-pressure cylinder only, is here found to be fully adequate to the requirements of regulation.

The intermediate pressure valves are, however, fitted with an entirely new motion, which forms one of the most interesting features of the engine. In consequence of this motion the valves, while essentially slide valves, do not have the early release or excessive compression

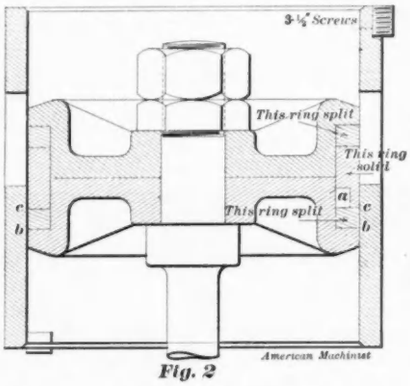


Fig. 2

HIGH AND INTERMEDIATE PRESSURE VALVES.

which is characteristic of such valves when operated at short cut-off. The restricted port opening of slide valves at early cut-off is also in a considerable measure increased. This effect is accomplished by giving the valve a movement which is the resultant of two eccentrics—one being of the usual swinging construction used with shaft governors, and the other being stationary and attached to the frame of the engine, its purpose being to swing the swinging eccentric regularly twice across the shaft and back for each revolution. This double-eccentric construction is clearly shown in Fig. 3, in which the swinging eccentric will be seen at *a*, arranged to swing about the swing pin *b*. The fixed eccentric has the same eccentricity as the swinging one, and is shown at *c*, bolted by a flange to one of the pillow blocks. Upon an arm of the pulley-like piece which carries the regular eccentric, is journaled the rock shaft *d*, having an arm at each end. One arm connects to a pin in a hub attached to the strap of the fixed eccentric. It is obvious at once that as the shaft revolves, this arm *e* will be oscillated by the stationary eccentric through the arc shown; and the second arm *f*, upon the opposite end of the rock shaft, will be oscillated through a similar one, as shown. This second arm connects, by means of the link *g* and the pin *h*, with the regular eccentric carried by the shaft, and the oscillation of the rock shaft causes the shifting of the eccentric across the shaft—this movement taking place with regularity as the engine revolves. In other words, the path of the eccentric center, as it revolves around the shaft, is not a circle, but a curve which approximates an ellipse. The nature of the requirements, as will be shown later, involves the necessity of making this excursion of the eccentric twice for each revolution of the shaft, and this is accomplished by so locating the second rock-shaft arm that in its median position it occupies a dead-point position with respect to the link *g*—that is, in this median position the arm *f* and link *g* form a straight line, as shown in the figure. From this it will be seen at once that a complete movement of the arm *f* from position *i* to *j* and back again, will cause two complete oscillations of the eccentric. The effect and purpose of this movement of the eccentric will be apparent from the next diagram, Fig. 4.

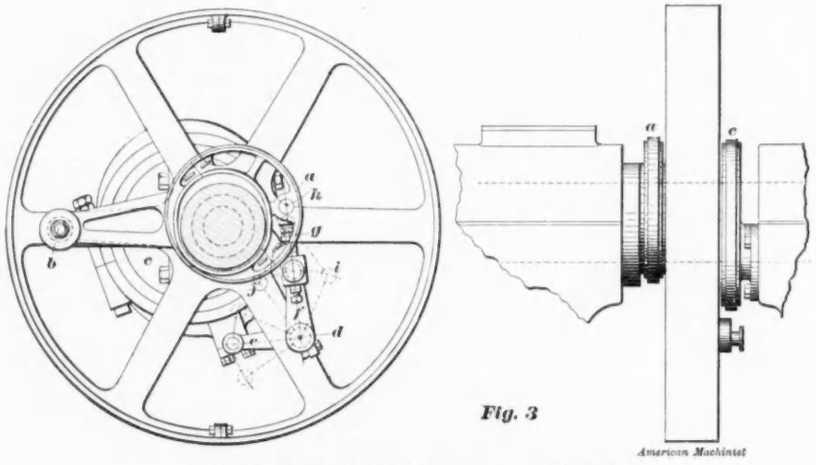


Fig. 3

INTERMEDIATE PRESSURE ECCENTRIC GEAR.

The crank is shown on the upper center at *a*; the direction of movement being to the right, and the swing pin of the regular eccentric being at *b*. The center of this eccentric for this position of the crank is at *c*, and the pin by which it is moved across the shaft is at *d*. The center of the stationary eccentric is at *e*, and the center of the rock shaft at *f*—the two arms of the rock shaft being shown in several relative positions. It is well understood, of course, that with the usual shaft-governor movement the eccentric is moved inward to accomplish a shorter-cut-off—this inward movement being also accompanied by a reduced travel of valve and port opening, and an earlier release and compression. With the present arrangement the idea is to have the eccentric at an inward position at cut-off, and an outward position at release and compression—the cut-off being thus at a point determined by the inward position, and the release and compression at points determined by the outward position. In Fig. 4, the elliptical path of the eccentric is determined by construction. The most obvious way of doing this would be to conceive the shaft to turn, lay out successive positions of the rock-shaft arms, and thus determine successive positions of the eccentric center. Since, however, the only office of the stationary eccentric and rock shaft is to oscillate the moving eccentric across the shaft, the path of the moving eccentric may be more easily laid out as follows: The office of the fixed eccentric being simply to oscillate the swinging eccentric across the shaft, it follows that, if we can first determine the angle of oscillation for various

angles of rotation of the shaft, it will then be easy, by conceiving the rotation to take place, to locate points in the path of the swinging eccentric. This oscillation is effected in the engine by revolving the swinging eccentric; but the same oscillation (without the rotation) would be effected by turning the fixed eccentric backward. Assuming, then, an angular movement of the fixed eccentric backward from *e* to *g*, and carrying the movement through the parts, we find a movement of the swinging eccentric across the shaft to a position represented by the line *b h*. Laying down the line *i j* to represent the same angular rotation of the shaft, we have the point *j* where the swinging eccentric center would be had it not been swung across the shaft. From this point we lay out a short section *j k* of the path across the shaft in the new angular position, and from *j* we lay off a distance equal to *c l*, the actual movement of the eccentric in oscillation, and obtain point *k* in the actual path of movement. In the same way additional points are found, and the elliptical-shaped path curve for a half revolution laid down as shown.

Line *m n* gives, by its distance below the center of the shaft, the lap of the main valve; and the point *o*, where the eccentric path crosses this line, gives the position of the eccentric at cut-off. Had the path of the eccentric for this cut-off been, as usual, the circle drawn through this point, the port opening would have been *p q*; whereas, with the actual path, the opening is *p r*. Similarly, had the path been this circle, release and compression (with no inside lap) would have been at *s*; whereas, with the actual path, they are at *t*. In other words, the cut-off is that due to a throw of *i o* or *i q*, the port opening is that due to a throw of *i r*, and the release and compression are those due to a throw of *i t*. Of course, a similar path is required for the moving eccentric during the return stroke, giving rise to the necessity for two oscillations of this eccentric for one of the rock shaft, as has been already pointed out.

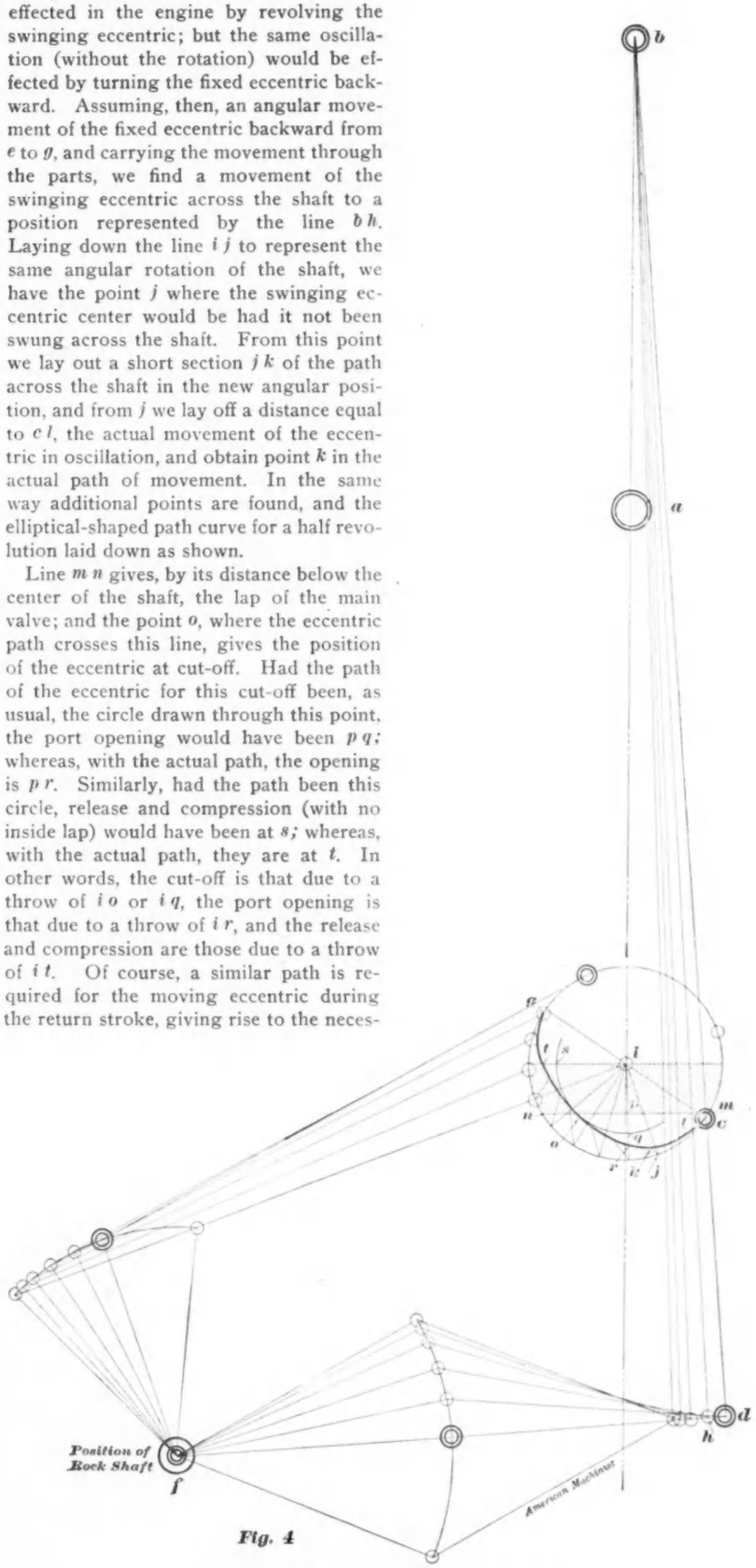
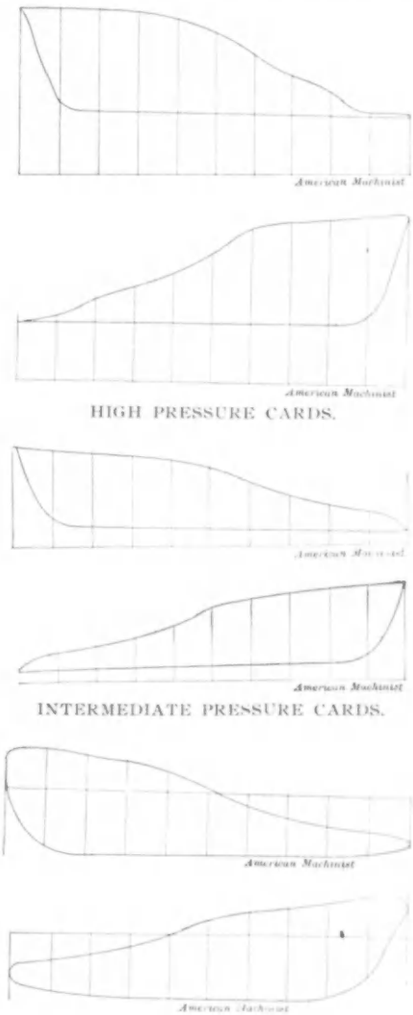


Fig. 4

SECTION OF DOUBLE ECCENTRIC GEAR

Fig. 5 shows indicator cards from the various cylinders. The high-pressure cards show the well-known early release and compression due to the single-eccentric shaft-governor gear; the cards from the intermediate cylinder show the effects of the new gear in the later release and compression, but especially the former; while the cards from the low-pressure cylinder show what may be expected from a four-valve gear. The effect shown for



HIGH PRESSURE CARDS.

INTERMEDIATE PRESSURE CARDS.

LOW PRESSURE CARDS.

Fig. 5.

the new gear is confined mainly to the release, because the valves for the high-pressure cylinder have negative inside lap, while those for the intermediate cylinder are line-and-line.

Fig. 6 shows these cards combined in the usual manner. The areas of lost work will be seen to be very small. The theoretical expansion curve drawn in is the usual simple hyperbola. The combined card was laid out from the actual cards shown, with the proviso that the pressures laid down on the combined card are

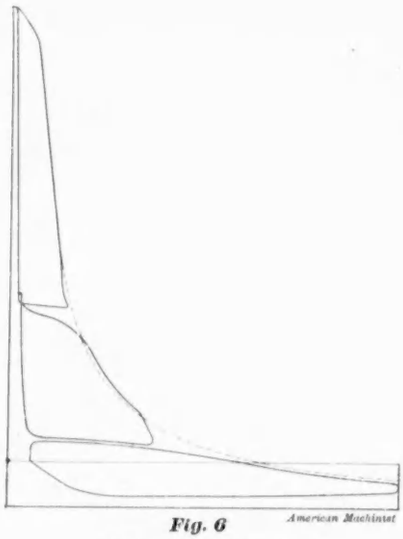


Fig. 6
COMBINED CARDS.

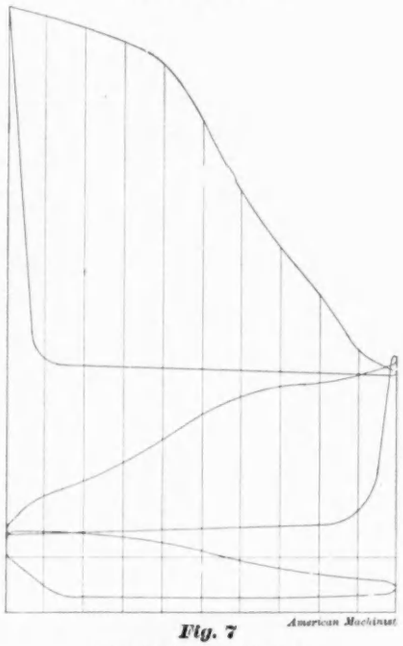


Fig. 7
TRANSPOSED CARDS.

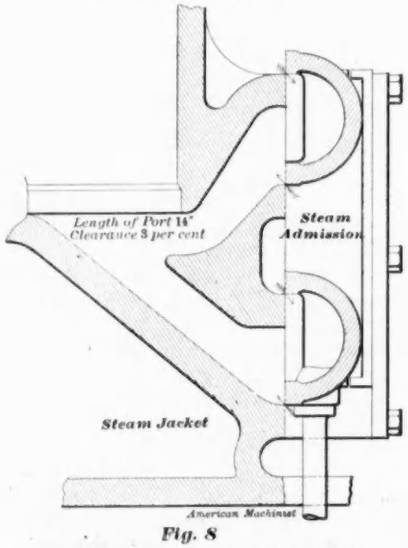


Fig. 8
LOW-PRESSURE STEAM VALVE.

in all cases the mean of the pressures shown by the cards from the two ends of the cylinder. The expansion curve of the intermediate cylinder will be seen to extend beyond the hyperbola, while that of the low-pressure cylinder falls below it. This is believed to be due to the presence of a reheating receiver between the high and intermediate cylinders—the receiver between intermediate and low-pressure cylinders having no reheating coils.

Fig. 7 shows transposed cards, in which all are laid out of uniform length and to the same pressure scale. The pressures laid down are, as with the combined card, the mean of both ends, and the cards are so disposed as to show the manner in which the steam goes through the engine.

The construction of the valves for the low-pressure cylinder is shown in Figs. 8 and 9—the former being the steam and the latter the exhaust valve. Both are multiple-ported, as will be seen, the steam valve giving four openings and the exhaust three. The steam valve will be seen to be fitted with a cover plate, which, however, is not a balance plate, but is intended simply to prevent the lifting and rattling of the valve under a fixed compression and the reduced receiver pressure of light loads. The valve is fitted with a gib, as shown. The exhaust valve is fitted with a somewhat similar device, not shown.

about 45 per cent. of the travel which would be required by a plain eccentric movement. This construction is shown, though not to scale, in Fig. 10, which shows the arrangement for the steam valves. The gear for the exhaust valves is, of course, upon the opposite side of the cylinder and is of similar character.

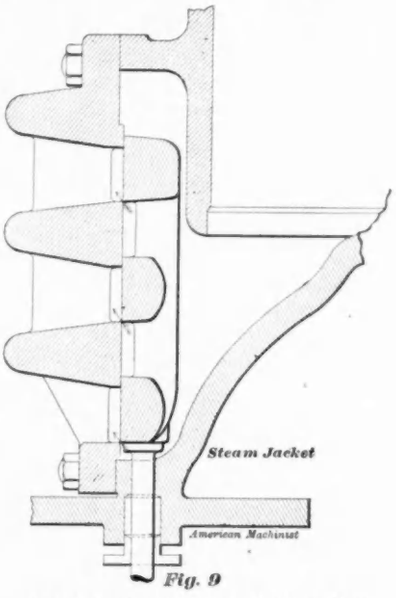


Fig. 9
LOW-PRESSURE EXHAUST VALVE.

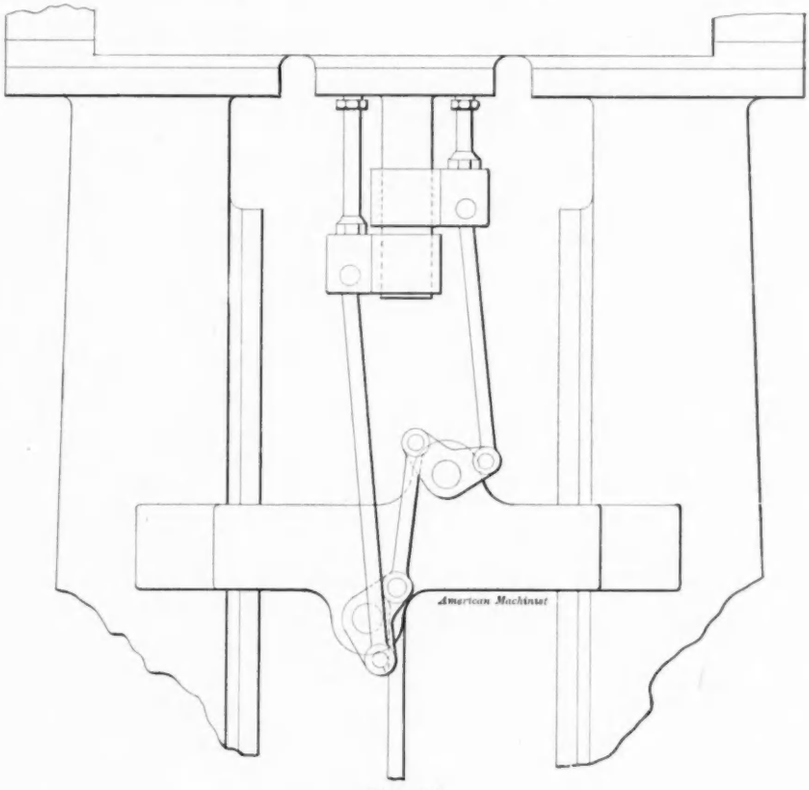


Fig. 10
QUARTER-CRANK PAUSE GEAR.

A quarter-crank pause gear is introduced into the motion of these valves in order to reduce the idle travel, whereby a given port opening is obtained with

The actual angular movements of the quarter cranks are shown in Fig. 11.

The intermediate receivers are formed by the exhaust chest of one cylinder and

the steam chest of the next, which are bolted together by flanges which are covered by the iron lagging shown in the half-tone engraving, Fig. 1. In the receiver between high and intermediate cylinders, a reheating steam coil is introduced. The covers of all cylinders, but not the barrels, are jacketed, and, together with the receiver reheating coil,

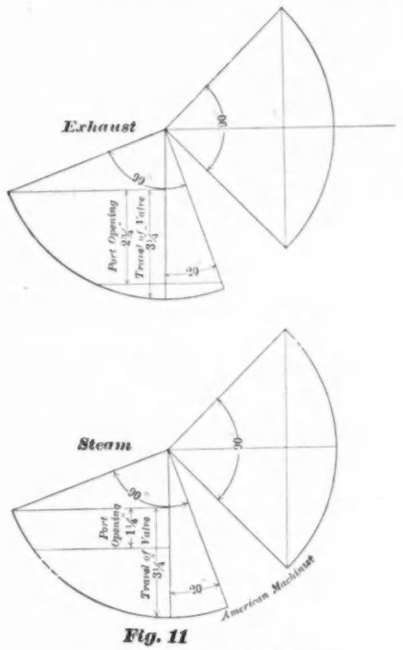


Fig. 11

DIAGRAM OF PAUSE GEAR.

are supplied with steam at full boiler pressure, which is 150 pounds.

The condenser is located below the floor and is of the Deane independent type. The rated capacity of the engine is 600 horse-power, and the speed when the cards were taken was 126 revolutions per minute.

The engine was built by Wm. Todd & Co., of Youngstown, O., from designs by Mr. E. F. Williams.

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Arms of Pulleys and Fly-Wheels.

Editor American Machinist:

What is d in the fly-wheel formula published in your issue of April 23d—diameter in feet or inches?

Should not x and y depend also on the number of arms? How many arms do you recommend for different diameters?

WM. KENT.

[The portion of the width of arm determined by the diameter is given as four per cent. of the diameter, and it makes no difference what units are used. The dimensions of the arm are naturally in inches, and the use of inches for the diameter is consequently more convenient than feet.

All the fly-wheels to which the formula has been applied have six arms, and for wheels of the sizes which are cast in one piece there is seldom any need of more or less. From the shop point of view, six arms, or for very small wheels three, is of course the only correct number, as it enables the wheel to be chucked by three equally spaced arms. If one wishes to split hairs, the dimensions of the arms may be varied with their number; but there is small need within usual limits of varying either. A wheel cast in a single piece is a radically different structure from a segmental wheel, from whatever point of view it is looked at. The chief point for a wheel in one piece is to be able to cast it with a minimum of risk. The strains upon the rim of a solid wheel are precisely like those upon a tube under pressure. There are no joints needing to be strengthened by having arms near them, and the rim being rigid, and of far greater cross-section than the arms, the centrifugal forces are scarcely felt by the arms. The working strains which are felt by the arms, are chiefly those due to the acceleration and retardation of the rim, and there is little need of varying the number of arms with the diameter except as a matter of habit or usage. A solid rim has as little need of assistance from its arms against bursting as a boiler has of radial stays. F. A. H.]

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The American Society of Mechanical Engineers on the Wilson-Squire Bills.

The American Society of Mechanical Engineers has taken such action as seems appropriate in relation to the "line and staff fight" now going on in Congress, by action of the Council, which has called attention of the membership to the matter, and suggested that each member write to the Senators from his State and to the Representative from his District, urging their active co-operation in passing the Wilson-Squire Bills.

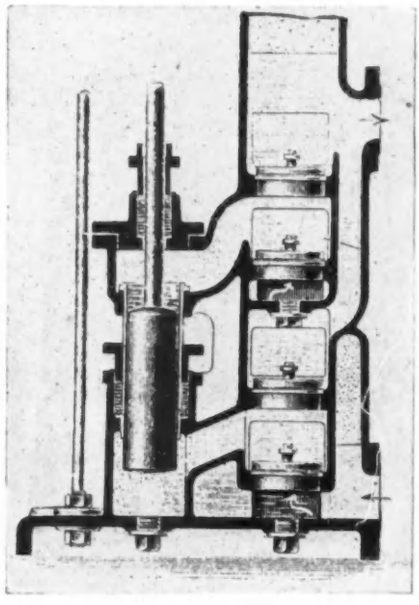
In taking such action the Council does not, of course, commit the society to participation in the fight; but we regard it as entirely proper and right that individual members should be thus urged to exert their influence for the right in a contest wherein every engineer is deeply concerned.

It ought to be generally recognized that the naval engineers represent the profession of Mechanical Engineering in the Navy, and the treatment they are receiving is a reflection upon and an injury to everyone interested in the welfare of the profession.

We would suggest that those of our readers who are not members of the American Society of Mechanical Engineers also write letters to their Senators and Representatives, urging the justice and importance of the Wilson-Squire Bills, Senate No. 735, House of Representatives No. 3618.

Pump Plunger With But One Stuffing Box Gland.

"The Maschinen und Armaturfabrik, of Frankenthal, Rhenish Prussia, constructs a type of pump with plunger piston in which there is but one stuffing-box gland, an arrangement that has the advantage of greatly reducing the friction, and consequently the work lost in overcoming it and the wear of the moving parts. As may be seen from the figure, the piston is guided by a metallic sleeve which forms of itself so good a jointure that it is un-



A GERMAN PUMP.

necessary to make the stuffing-box gland extremely tight. Another advantage is that the suppression of one of the stuffing-box glands makes a great reduction in the height of the pump, and consequently of the space it occupies."—"Glasers Annalen fuer Gewerbe und Bauwesen."

[The pump shown is interesting—if for nothing else, because it would work just as well with two upper valves removed. See the sketch of a pump in our issue of March 19th.—Ed.]

▲ ▲ ▲

In the captions to the engravings of the indicator cards shown in connection with Mr. Batcheller's article on High-Pressure Air Compressors, which appeared last week, the memoranda of the scales of the cards should have read "scale of original cards." The cards being reduced in size from the originals, the scales are, of course, changed. They were introduced in the diagrams in order to give a realistic idea of the pressure dealt with.

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The Otto Gas Engine Works have brought suit against the New Era Iron Works Co., for infringement of an electrical igniter patent.

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Foreign Trade of American Machinery Builders.

There is a little joke connected with the foreign business of our tool and machinery builders, and one is likely to see this joke when he innocently makes an inquiry about the foreign business of any particular establishment. He usually finds that this particular house supposes it is doing about all the foreign business in its line, and that little or nothing ought to be said about it, because "the other fellows" (competitors) will find out about it and cut into the trade. Then, if the inquirer goes to "the other fellows," he finds them talking the same way—the fact being that a good deal of foreign business is being done all around by live concerns, and most of them think the others are not doing much in foreign fields.

A very considerable proportion of the correspondence in this office now grows out of inquiries received from our foreign readers regarding American machinery and tools. We are constantly being asked to name the builders of machinery suitable for specified purposes, and it is quite common for these foreign correspondents to say that they prefer an American machine and wish to manufacture by American methods.

It is, of course, gratifying to us to know that we have been able to exert an important influence in the introduction of American machinery abroad; but the main point is that foreign users of machinery are very much alive to the merits of American machinery and tools and are rapidly becoming more so. It is our belief that it is to the best interest of every American machinery builder to develop this foreign trade as much as possible; but he should not assume that his neighbor is not equally well aware of this fact.

▲ ▲ ▲

To Take the Tariff Out of Politics.

We are asked to announce that "the National Tariff Convention will be held at Detroit, June 2d," and that "delegates from the different commercial, manufacturing, labor and agricultural organizations of the United States will meet there and endeavor to put the Tariff question upon a permanent foundation by taking it out of the political vortex and placing it in the hands of business men."

The above statement constitutes the desired announcement; and now it seems proper to add that any attempt to take out of politics a question that concerns every citizen of the country, and one that nearly every citizen has an opinion upon one way or the other, will, in the nature of things, fail. The very foundation principle of this government is involved in the fact that the wishes of the people are supposed to be embodied in our National policy. The wishes of the people can only be ascertained by elections, and discussion of public measures must precede the elections.

We may regret the disturbance caused by discussion of the Tariff, and this disturbance is undoubtedly increased by the influence of unscrupulous and unprincipled politicians; but, nevertheless, just such discussion and such efforts to secure majorities for one or another policy, with regard to public questions, is a fundamental principle of our system of government, and important public questions cannot be taken out of the hands of the people and settled by "commissioners" or others without reorganizing our social structure.

This may be a matter of regret, or it may not. We are all familiar with the evils of the present system, but have no assurance that a change would not be for the worse; and at any rate, the Tariff question, or any other question, is not at all likely to be taken out of politics except by such overwhelming and repeated majorities for one side or the other as will convince the minority that the settled policy of the country has been declared and embodied in legislature.

Whether we regret or rejoice that this is so is immaterial; we must face facts as they exist. Whenever the people are divided in opinion upon any important public question, they will discuss that question and vote upon it—and that is politics.

We hope every reader of the "American Machinist" will discharge his duty as a citizen with regard to public questions, and when he tires of political matters he can go fishing or read this journal, which will be free from politics.

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Literary Notes.

THE SLIDE RULE. A Practical Manual. By Chas. N. Pickworth. Wh. Sc. Second Edition. Emmott & Co., Manchester, England. 5 x 7 inches; 56 pages. Price, Two Shillings.

We are glad to notice the appearance of the second edition of this book, which, in its treatment of the subject more nearly fills our idea of what is needed by the average man than any other with which we are acquainted. The theory of the rule is boiled down to its simplest elements, with the result that, while mathematical knowledge is not required to read it, the reader will nevertheless acquire a rational idea of the operations of the instrument, and not be compelled to use it in blind faith and by rule-of-thumb.

HOW TO SAVE MONEY IN RAILROAD BLACKSMITH SHOPS BY THE USE OF BULLDOZERS AND HELVE HAMMERS. By Orville H. Reynolds, M. E.

The matter treated in this pamphlet is well indicated by the title, but it should be added that the information given by the text and engravings could be profitably used in many other forge shops besides those of railroads. Forty illustrations are given, showing just how dies and formers are made, and the successive operations are performed in making a variety of work used in car construction; and any practical man can, of course, readily apply the principles shown to other lines of work. The pamphlet has 18 pages, standard 6 x 9 inches, and is sold at 25 cents by its publishers, "Locomotive Engineering," 256 Broadway, N. Y.

▲ ▲ ▲

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

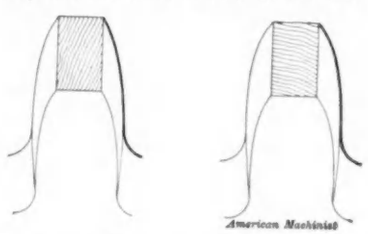
(93) F. B., Chester, Pa., asks: Is there anything made in the form of bearings for shafting which will run without any lubrication in about 200 degrees Fahr. at from 15 to 20 revolutions per minute? A.—Roller bearings or ball bearings are perfectly suited to those conditions. No rubbing surfaces of any material will run continuously without a lubricant.

(94) L. S. asks: How can we arrange our lathe to cut metric threads? A.—Metric threads are usually counted as so many threads per centimeter, and as one inch is to one centimeter as 1 to .393704, it is only necessary to reduce the motion of the screw in that proportion to give as many threads per centimeter as the lathe would ordinarily cut per inch. This can be done by introducing into the screw-cutting train a compounding stud having two gears—one with 50 teeth, the other with 127. These two gears are in the proportion of 1 to .3937007, and the error between this and exactitude is so small as to be negligible.

(95) D. C., Buffalo, N. Y., asks: To what extent is the driving power of a belt affected by the diameter of the pulley over which it passes, it being understood that the pulley in all cases is to be wrapped one-half its circumference, and the tension and velocity of the belt to remain unchanged? In other words, will not a pulley 12 inches diameter, running at a speed of 1,000 turns per minute, transmit as much power as one 24 inches diameter, running at a speed of 500 revolutions per minute? A.—The power that can be transmitted by the two pulleys should be precisely the same, and within practical limits we think there is no difference by such changes of diameter so long as the belt speed remains the same.

(96) H. B., Chicago, asks for a method of measuring the steam used by a tenant for different purposes and in varying quantities. A.—The only steam meter of which we have any knowledge is the one designed by Mr. C. E. Emery for the New York Steam Co. This consisted of a self-adjusting hole through which the steam passed. A loaded piston or diaphragm kept the hole of such size as to maintain a constant difference of two pounds pressure between the two sides. A pencil and strip of paper (driven by clockwork) made a permanent record of the varying size of the hole, which was used as a measure of the steam flowing through the meter. The meter is similar in principle to the measuring box used in the mining sections of the West for measuring the flow of water. This box has an adjustable hole, which is adjusted to keep a constant head in the box, when the size of the hole becomes a measure of the water flowing.

(97) J. N. R., Minneapolis, Minn., sends us sketches of a couple of gear teeth and asks: Which is the best way of blocking out cogs for cone gears so as to give best results? A.—We understand the question to refer to the teeth for a bevel mortise gear. The teeth are, of course, made so that the grain of the wood is approximately perpendicular to the face of the gear, and the lines shown in the sketch



we understand to be the growth rings on the end section of the wood. We prefer the right-hand sketch as being somewhat less liable to split or peel off, but probably little attention is paid to the matter. The planks are usually sawed to get as many as possible out of the log, and the teeth are cut to get as many as possible out of the plank.

▲ ▲ ▲

Business Specials.

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear wheels, gear cutting. Grant; see page 26.

Forming Lathes, Mer. Mach. Tool Co., Meriden, C.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Honest Mach. Oils. F. S. Pease Oil Co., Buffalo, N. Y.

Engine Castings ¼ to 2 H. P. Finished boilers and engines. Grant Sipp, Paterson, N. J.

Bevel and miter gears cut with perfect planed teeth. Boston Gear Works, Boston, Mass.

Aluminum and Brass Castings, Machinery, Name Plates. Twining Campbell, Paterson, N. J.

Marine Iron Works, Chicago, builders of steam yachts and marine machinery; catalogs free.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Key Seaters for any length of hub or width of keyway. New, handy machines. Mitts & Merrill, 913 Tilden street, Saginaw, Mich.

Duplex and special gear cutters, counterbores, cutter and surface grinders, vertical millers, hand punches and shears. R. M. Clough, New Haven, Ct.

Patent Soliciting of High Class.—D. Walter Brown, Counsel in Patent Cases, 111 Broadway, New York. Send for "Brief History of Patent Legislation."

For Sale—A fair sized foundry and machine shop with additional land, in good condition and well equipped for medium heavy work; located on a railroad; within eight miles of New York. Can be seen in operation for few weeks only. Owners giving up business. Terms easy. Call or address Room No. 41, 22 William street, New York.

▲ ▲ ▲

Some Stamping Tools.

BY A. H. CLEAVES.

Perhaps some reader may be interested in a device much used in lettering watch plates, etc., as a substitute for hand engraving.

The names that are placed on watch plates regularly are stamped, as a general rule, instead of being engraved as formerly. Figures and borders for chased work are impressed in the same way.

The fixture for stamping shown in Figs. 1 and 2 was formerly used quite extensively by itself, but has since been supplemented by the one illustrated in Figs 3 and 4, and has been used quite a long time in combination with the same.

In Fig. 1 a plunger *A*, with stamps or stamp blank *B*, is guided by the stand *C*. The movable arm *E*, with swivel piece *D*, is used for transmitting a blow from a hammer to *A* and *B*, for taking impressions from dies, and formerly for stamping directly.

The name, figure, or whatever it may be, is first engraved in a block, which is hardened and located in any convenient way under the stamp blank *B*, in as favorable a position as convenient for bringing the stamp *B* readily over the work to be marked afterwards. One of these stands then is used by the engraver or die-cutter for taking impressions on the stamp from which he cuts away the stock; another stand is used in the stamping room; and the several stamps are furnished each with a collar guide like *F*, Fig. 2, shown in plan and side elevation, accompanying a plunger *A*, Fig. 1, for the same. Then a sliding plate or holder, shown at *G*, Figs. 1 and 2, brings the work, such as top plates to watches, etc., under the stamp *B*. There is one of these for each stamp; so that when any particular stamp is used, each one being dowel-pinned into *A*, and *A* being guided by yoke or fork *H*, on *F*, Fig. 2, the work is always located without setting by *G*. *G* is provided with stop screw *I* and gibs *J J*, to take up any wear.

If a top plate to a watch, which has regular holes punched in it, is to be lo-

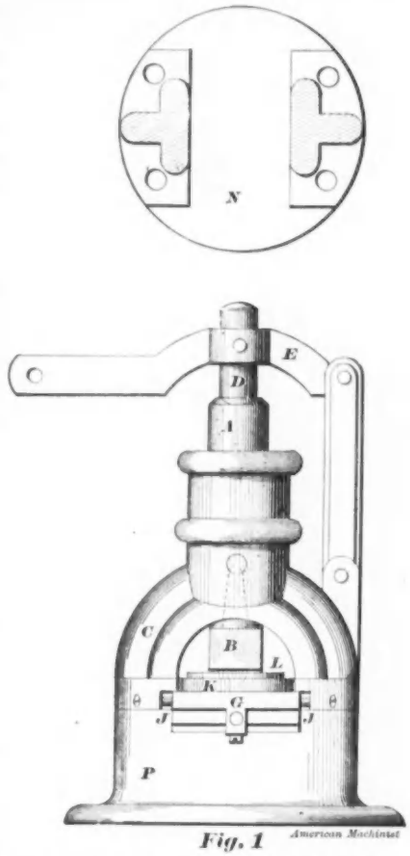


Fig. 1

STAMPING PRESS FOR WATCH PLATES.

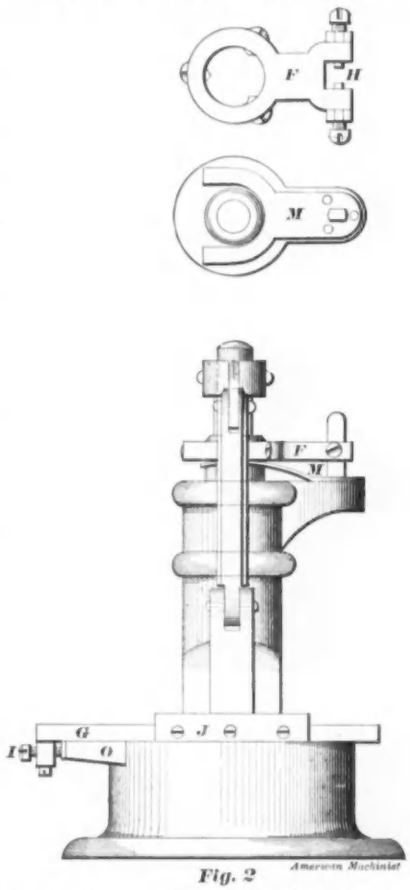
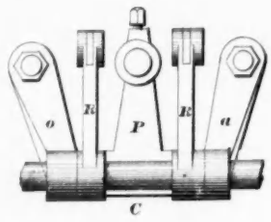


Fig. 2

STAMPING PRESS FOR WATCH PLATES.



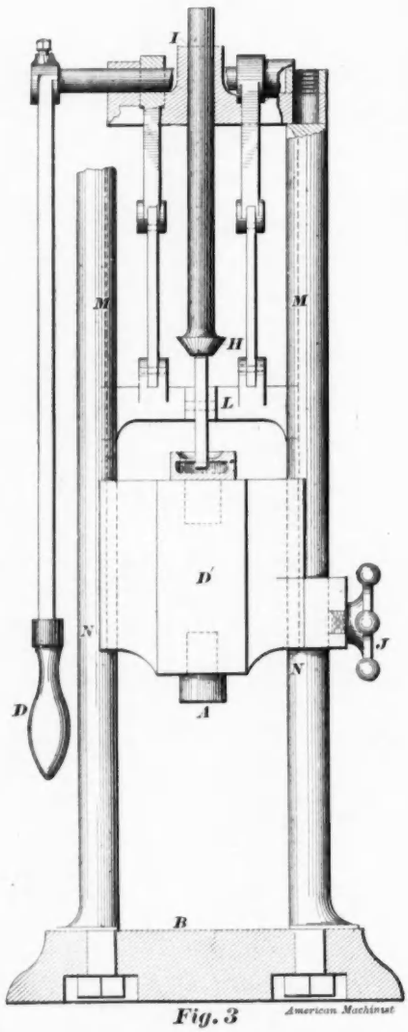


Fig. 3

FRONT VIEW OF SMALL DROP HAMMER.

cated, or can be, by stamping a blank piece, soldering or shellacking the same upon a top plate in proper place, then place the plate with this stamped piece fastened to it under the stamp with the same in the impression. Then the top plate *L*, Fig. 1, is soldered or clamped to *G* or intermediate block *K*, if used, and holes for pins are drilled in the block through the holes in the plate.

If desirable, a number of blocks like *K* can be used with one slide like *G*; but in the drawing, *K* is intended to show a die block for impressing *B*, which can be adjusted with screws at *I* and *J* when the gibs are removed.

M M, Fig. 2, show a spring for lifting stamp; but the latter is always brought down to the work before striking the blow. It was formerly the practice to stamp the work by striking the piece *D*, Fig. 1, with a hammer, as uniformly as possible; but the results were never uniform or satisfactory. So E. J. Bradford, of Springfield, Ill., designed the drop machine shown in Figs. 3 and 4, which has proved very efficient.

In Fig. 3, the space between the hammer *A* and the base *B* is adapted to receive the stand shown in Figs. 1 and 2. The handle *D*, Fig. 3, is used to lift and release the weight D^1, through a system of levers, etc., shown in front and side view at Figs. 3 and 4, and plan at *C*, Fig. 3. They are connected with the cross-bar *L* running in grooves *M M*, while D^1 has grooves running on the posts *N N*. In the plan *C*, *O P Q* are all one casting, allowing passage of *R R R*.

The two hooks, shown best at *E*, Fig. 4, and supposed to have a spring between

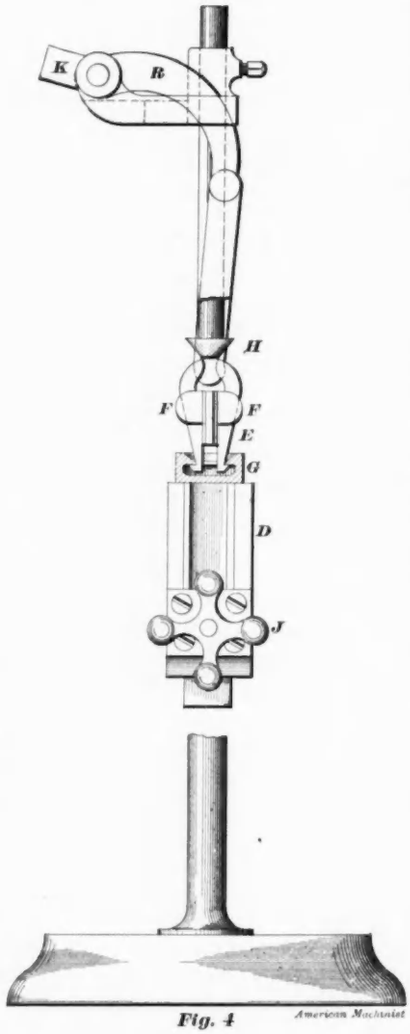


Fig. 4

SIDE VIEW OF SMALL DROP HAMMER.

them below the joints *F F*, Fig. 4, snap into *G* when forced down; and when lifted to the proper height, are opened by the rod *H*, with conical end, which releases the weight D^1. The rod *H* can be marked at some convenient point like *I*, or an index used to show the place to set it for each stamp, as the required fall is decided in each case.

The spider handle *J*, has a safety screw for locking the weight while setting the stands, etc., to avoid any accident. *K* is intended for a counter balance, if needed.

This plan for stamping is very satisfactory, as the weight is very sensitive and positive; something quite difficult to obtain in an arbitrary press when there is any variation in the thickness of the metal to be stamped. In the use of the drop, the attachments *E D*, Fig. 1, are dispensed with.

Chicago, Ill.

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Help Wanted.

Situation and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our subscription list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Foreman boiler maker wants position. A 1 references. Address I. J., AMERICAN MACHINIST.

Wanted—Pos. as draftsman by tech. grad. with shop and drawing office exp. S. W., AM. MACH.

Wanted—Steady pos. by mech. dftsman and designer. A 1 references. Box 101, AM. MACHINIST.

Contractors and mfrs wanting a live agent in W. Mich., add. V. Sebring Hillyer, Grand Rapids, Mich.

Practical and successful designer; A1 draftsman; 20 yrs. varied exp. High grade eng. a specialty. Now open for eng. Address Box 263, Ridgway, Pa.

Wanted.—An experienced pattern maker to take charge of pattern shop in architectural iron works. Address James McKinney & Son, Albany, N. Y.

Mechl. engr., technical trained, 12 yrs., exp. as machinist, des'r and as foreman of drawing room, wants responsible position. Box 100, AM. MACH.

Wanted—Mach. tool salesman for New England States. Must have exp. and acquaintance. Largest mach. tool co. in the country. Box 99, AM. MACH.

Pattern maker desires pos. as foreman in a mfg. company. Exp. in pump and engine wks. and gen'l mach. pat'ns. Sober & energetic. C. F., AM. MACH.

Exp. brass f'ndry f'man would like to correspond with parties requiring the services of a competent man. Add., Up-to-Date, care AMER. MACHINIST.

Assistant foreman wanted in a Corliss eng. shop near New York; one well up on tool work. Address, giving age, experience and references, Foreman, Box 96, AMERICAN MACHINIST.

Wanted—Sit. as foreman, assist. foreman or job hand, by man with thorough knowledge of mach. business. Will take job as ordinary machinist at ordinary pay. J., AMERICAN MACHINIST.

Wanted—Experienced mechanical draftsmen, North and West, having evenings free. State where regularly employed. Edwin Guthrie, Patent Attorney, Corcoran Building, Washington, D. C.

Wanted—Thor'ly prac. mech'l dftsman, must be exp. mach. designer; only those capable of being engaged on probation need apply; state refs. and sal. expected; position in Phila. Box 97, AM. MACH.

Wanted—Several first-class men in Brooklyn, N. Y., to make blanking and stamping dies for sheet metal bicycle parts. Permanent jobs to exp. men in this line. Address A. B. C. D., care AM. MACH.

Mechanical engin'r, technical graduate, open for engagement; 3 yrs.' exp. in erection of large manf. plant; engine and general machine designer; also in managing men. Box 95, AMERICAN MACHINIST.

Change of pos. wanted by a technical grad. with 7 yrs. practical exp. on high-grade engs., mining machy. and tools. Understands mining, metallurgy and chemistry. Good refs. H. M., care AM. MACH.

Wanted—Situation as supt. or foreman. Designer of special tools and fixtures for brass and iron. Knowledge of patterns and core work, also management of shop and men; good ref. Box 91, AM. MACH.

Mechanic, age 50, with long exp. as form'n, supt., constructing engr., dftsman and desig'r in special and gen. mach. works wants similar pos. Middle, Western or Southern States preferred; highest references. Mechanic, 48 Clifton ave., Chicago, Ill.

Do you need a supt or M. E.? Advertiser has a thorough tech. education and 15 yrs. practical exp. on general machine work, machine tools and automatic labor-saving machinery. Open to engagements after March. Add., Box 86, AM. MACHINIST.

Wanted—A first-class foreman for the management of a core shop where about forty core makers are employed. Location of shop within ten miles of New York City. Applicant should be familiar with piece work system. Address, stating experience, P. O. Box 14, Brooklyn, N. Y.

A large tool factory wants a thoroughly experienced engineer with college education and who is capable of acting as substitute for the technical director. First-class men will send their application, stating course of study, previous positions and references under S. 6148 to Rudolf Mosse, Vienna, to be forwarded.

Draftsman Wanted—Comp't man, familiar with mach. design'g and construct'n of jigs and tools can secure permanent sit., if satisfact'y; one who has had some experience in shop practice and is well versed in strictly modern methods, preferred. Address, stating age, experience, salary expected, etc., Competent, care AMERICAN MACHINIST.

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Miscellaneous Wants.

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Best and cheapest Bolt Header, made by C. H. Baush & Sons, Holyoke, Mass.

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Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

For Sale—Two Warner & Swasey speed lathes, in first-class condition. Penberthy Injector Co., Detroit, Mich.

For Sale—Foundry and machine shop in booming town on three railroads; shop and tools complete; established business; no competition. W. I. W., AMERICAN MACHINIST.

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Write for circular and address of nearest agent.
THE OHIO MACHINE TOOL CO.,
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After three months' trial we shall continue our **CASH POLICY,** as by its adoption we have lost no friends, but gained many cash customers on account of our close prices.

AS WE DO NOT MAKE THE LOSSES incurred in a credit system, we are consequently able to give our patrons the benefit of such saving.

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Sterling Depth Gauge, needed by tool makers die sinkers and machinists, each, by mail, **40c.**

Sterling Screw Cutting Lathe, for foot or power, with 6 inch 4 jaw Chuck, jaws reversible; set of Twist Drills, and set of English Crucible Steel Lathe Tools, for **$69.85**

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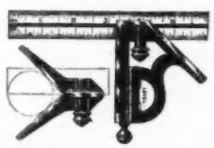

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The above prices hold good only while this special lot of stock lasts. Send your money and save. KEEP OPEN your eye for our NINETIETH ANNIVERSARY and address,

T. H. E. FRASSE CO.,
19 Warren St. (near Broadway), New York.

Commercial Review.

NEW YORK, SATURDAY EVENING, APRIL 25th.

The Iron Trade.

Pig iron has been defined as a thermometer of trade. If so, let us hope that it is an inaccurately calibrated thermometer, for one is reluctant to believe that this is as cold a day for all classes of manufactured goods as registered by the iron and steel market. The reports that have been published in these columns from manufacturers in various lines indicate that enough of the concerns are doing a good business to afford considerable ground for encouragement.

But the tone of the iron market is one of lassitude. The situation, indeed, is better than that of last year previous to the revival; prices are higher, billets, for instance, being considerably above last year's rates—and, withal, the pig iron production for the first quarter of this year was nearly one-fourth in excess of that for the first quarter of last year, though less than it was later in the season. But the buying side of the market has stubbornly refused to participate in any general movement toward animation in trade.

Meanwhile the selling side, treating the market as a balky horse, has plucked from every neighboring tree persuasive branches, by which we refer to the various pools or combinations that have been formed to fix the price of this, that and the other thing. But the efforts to goad the market by arbitrary advances of prices have accomplished, as yet, little except the staving off of demoralization of figures.

Unquestionably the Bessemer billet pool formed early in the month was, or was expected to be, the most important event in many weeks, but it has not "panned out" quite as was hoped for. Without definitely expressing an opinion as to the right or wrong of the action thus taken, we would merely say that its commercial results, in respect to a general stimulation of the iron and steel market, have fallen flat. However, the point directly aimed at, that of protecting the interests of the billet manufacturers, may have been successful, and we still await results. As a consequence of the combination, there was, indeed, a stiffening, temporary at least, in some lines, and Bessemer pig took the hint, even before the billet prices had been determined upon, and quickly advanced to from $1 to $1.50 above what it had sold at not long before. The prediction was made that it would go considerably higher, but prices that it has brought recently have anything but fulfilled this prophecy.

Another, though smaller, combination that went into effect about the same time as the billet pool, was that of a number of Southern pig iron furnaces, by which the minimum prices were raised 25 cents a ton. Subsequently some Alabama furnaces have farther withdrawn figures. A leading firm did a heavy business at various points in Southern irons during March, at the low rates prevailing, and they were in good tone early in April, but have subsequently become comparatively quiet. In fact, reports from many centers of the pig iron trade, after the first week of this month, were characterized by an encouraging animus that has not subsequently been maintained. The prices of Northern mill and foundry irons were not reduced to as low a basis as the Southern, but there has temporarily been better feeling in the Northern brands also, mill irons being a variety that was in some demand. The market for pig iron to be consumed in the New York district is practically limited

to foundry, and has been throughout featureless and apathetic.

Still further movements have, within a few weeks past, been on foot toward the consolidation of interests. The wire manufacturers have met in Chicago and advanced prices about $4 per ton; the bar iron men have convened in Cleveland and raised their figures to $1.20 per hundred pounds at that point; the steel rod makers have held a meeting in the same city and returned home without coming to a satisfactory understanding.

We have made inquiries of a few companies manufacturing power hammers, presses, etc., and have received the following replies, which are of a favorable nature:

The E. W. Bliss Co., Brooklyn, N. Y., makers of presses, dies and special machinery, say that their businesss has been quite satisactory for the last eight or nine months—in fact, considerably better than during the corresponding period of last year. "The demand for bicycle tools still constitutes an important element of our sales, and this, together with very considerable export shipments to nearly all parts of the world, makes the depression which seems to prevail in many lines of trade less appreciable to us."

The Bradley Company, Syracuse, N. Y., report: "The first four months of 1896, our sales of power hammers have been fully double in amount as compared with the same period of 1895. April, 1896, has been better than April, 1895, or March, 1896. Our customers have been principally the railroads and makers of bicycle forgings."

The Stiles & Fladd Press Co., Watertown, N. Y., manufacturers of presses, drop hammers, etc., say that, during the little over three months that their works have been in running order, they have received many orders, and at present have all the work that they can possibly attend to.

We close with favorable reports from some representatives of other classes of machinery. A Cincinnati machine tool company, the Davis & Egan, have been able to declare a three per cent. dividend for the first quarter of the year, and are arranging largely to increase the capacity of their works. The Providence Steam Engine Co., who are very busy and think the prospect for new work never seemed brighter, send a list of recent sales and installations, showing among a miscellaneous assortment of purchasers, rubber, paper and some Southern cotton mills. The Taunton Locomotive Mfg. Co., Taunton, Mass., have booked, since the 1st of March, some very satisfactory orders for water tube feed water heaters, etc.

Quotations.

NEW YORK, Monday, April 27th.

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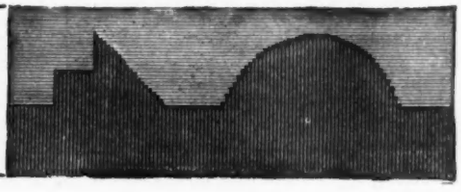
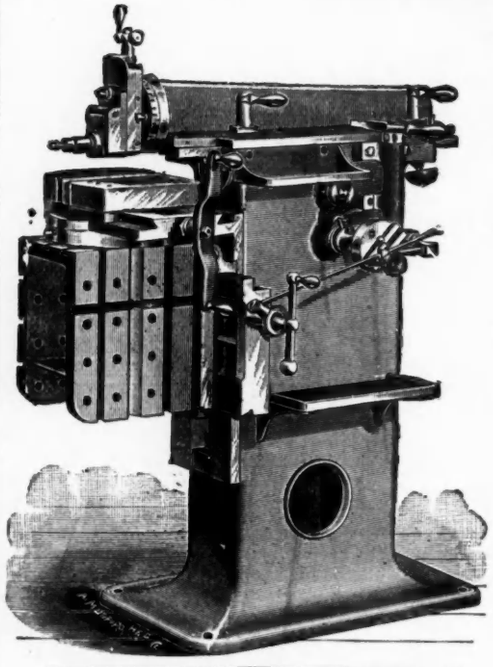
LATEST IMPROVEMENTS.
USEFUL ATTACHMENTS.
STRONG AND POWERFUL.

For Die Work, Tool Room, or General Machine Shop Work.

This Cut shows how stroke can be Adjusted with Machine in motion by the Micrometer Adjustment, fine and delicate.





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- The Stroke can be adjusted for Curves with machine in motion.
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- It has Adjustable Table for planing Taper Work.
- The Table can be removed for fastening work to the Apron.
- It has a strong, graduated swivel vise.
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- Buy the best.

The Hendey Machine Co.,

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FRANCE—FENWICK FRERES & CO., 21 Rue Martel, Paris; F. G. KREUTZBERGER, 140 Rue de Neuilly Puteaux (Seine).
CHICAGO—42 & 44 S. Clinton & Washington sts. BOSTON—47 Pearl st. NEW YORK—123 Liberty st.

FINE ADJUSTABLE PIPE DIES.

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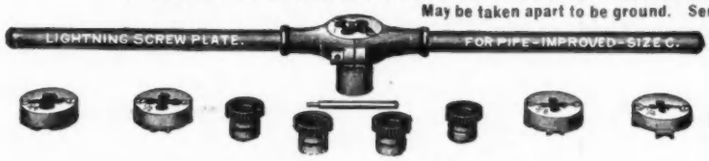

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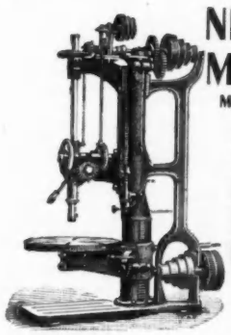

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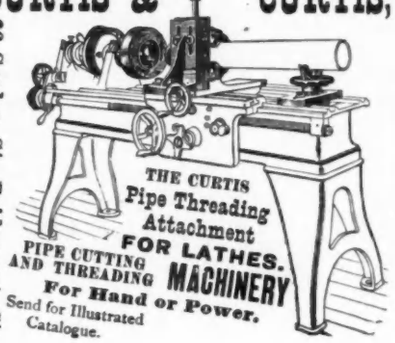

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▲ ▲ ▲

Manufactures.

The Baltimore Traction Co., of Baltimore, will shortly erect car repair shops. A few machine tools will be needed.

The Middletown Car Works, Middletown, Pa., are building an addition to their plant and will want new machinery for car building.

The Westinghouse Mfg. & Electrical Co., of Pittsburgh, Pa., is building a large addition to its foundry that will give employment to 50 new men.

The Blount & Edwards Machine & Foundry Co. has been incorporated at Milledgeville, Ga., by Lewis Blount and others. Capital stock is $25,000. New tools will be put in.

The George P. Sennet Foundry Co., of Toledo, O., are going to erect extensive buildings at Youngstown, O. Plans are completed, and the erection of this new plant will be begun immediately.

The North Point Construction Co., of Baltimore, has started work on their plant at Sparrows Point, Md. The company will be engaged in marine construction and will put in full equipment.

The Watt & Bro. Steel Co., York, Pa., was recently granted a charter. Capital stock, $30 000. They will shortly commence the erection of their plant and will be open for bids on new machinery, etc.

R. M. Clough, who heretofore has carried on a machine business in Tolland, Conn., will remove from that town and set up in New Haven, Conn. He expects also to increase his business considerably.

The National Lead Co. will build a large addition to their present plant in the Eighth Ward in Allegheny City, Pa. They have purchased a large piece of ground adjoining their works and will start building immediately.

Bryce Brothers, the well-known Southside, Pittsburgh, Pa., glass men, will move their Hammondville plant to Mount Pleasant just as soon as the necessary buildings can be constructed. The changes will involve an outlay of $50,000.

Messrs. Hugh Mathilath, New York, and Hugh Malcolmson, Manson Campbell, G. B. Douglas, F. B. Stevenson, J. A. Walker, of Chatham, Ont., Canada, have formed a company to manufacture a patent elevator, with a capital stock of $300,000, and a factory will at once be built at Chatham.

The American Projectile Company, Lynn, Mass., have leased the buildings formerly occupied by the Thomson Electric Welding Company and will move in at once. The former shop of the Projectile Company will be used as a blacksmith's shop; new machinery will be put in and about 100 hands will be employed.

The National Chuck Co., 39 Cortlandt street, New York, has brought out a new tapping attachment

to be used in the drill press or lathe. It is automatic, *i. e.*, when a hole is tapped to the proper depth the tap stops, and upon withdrawing the spindle the motion of the tap is reversed and it is rapidly backed out.

The Norfolk Ship Building and Machine Co. will be organized at Norfolk, Va. The capital stock will be $500,000. It is proposed to erect an offshore floating dock of steel, and construct a marine repair plant to operate in connection with same. J. P. Andre Molter, of Norfolk, is interested in this enterprise.

The Berlin Iron Bridge Co., of East Berlin, Conn., have the contract to furnish the New Britain Knitting Co. the steel buildings for their new boiler plant. The roofs will have steel trusses throughout, and in designing these buildings everything has been so constructed as to render them thoroughly fire-proof.

The Baltimore & Southern Railroad Co. are about to make improvements to the extent of $75,000 for two machine shops, docks and wharves. They are also in the market for six engines, twelve passenger cars, thirty box and gondola cars, sixteen freight and passenger stations, platforms, rails, fish plates, etc. Frank R. Biedlee, Baltimore, Md., is president.

The Tennessee Coal, Iron & Railroad Co., of Birmingham, Ala., is interested in the formation of a steel company, with $1,000,000 capital, together with the Louisville & Nashville R. R. Co., the Southern Ry. Co. and private parties of Birmingham. The company will manufacture rails and iron from Alabama ores, and will shortly be ready to consider equipment.

Several of the leading green bottle manufacturers have decided to erect a large plant in the Indiana Valley, Pa. This new plant is to have all the latest appliances. The concerns mentioned as being connected with the proposed plant are the Alton Glass Co., Alton, Ill.; Edward H. Everett Co., Newark, O.; O. Cunningham & Co. and D. O. Cunningham, of Pittsburgh, Pa.

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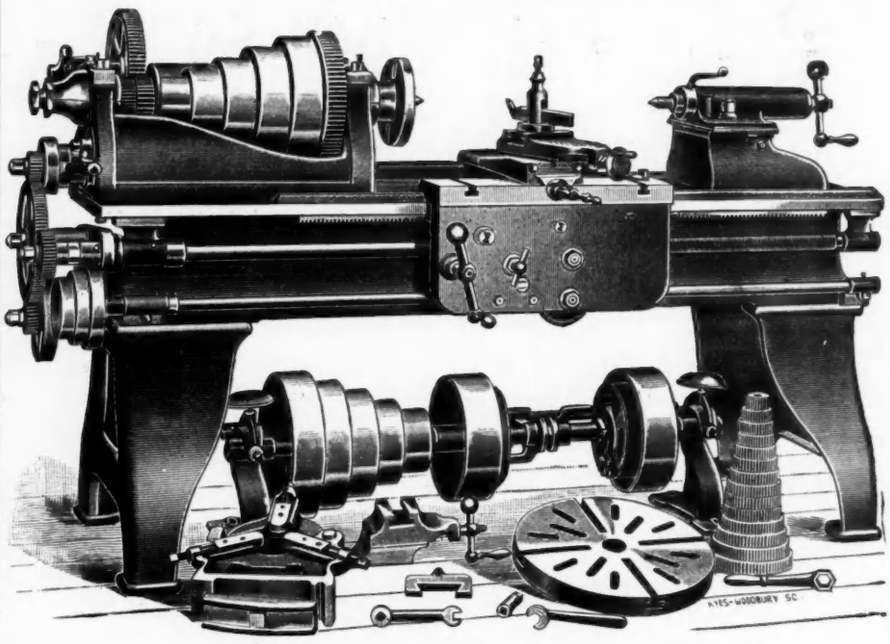

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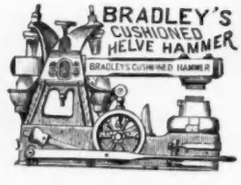

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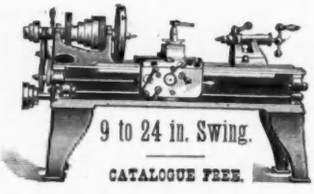

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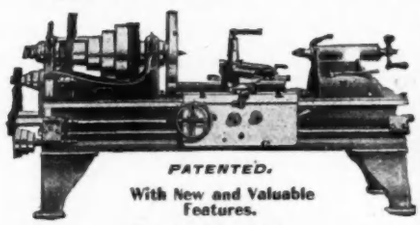

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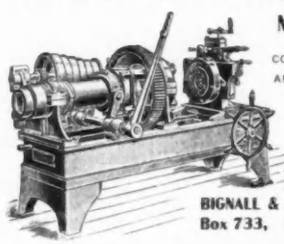

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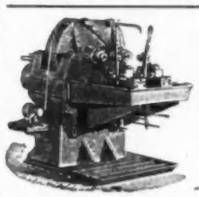

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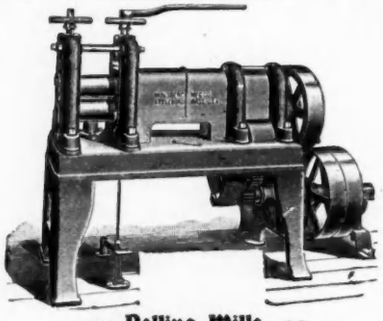

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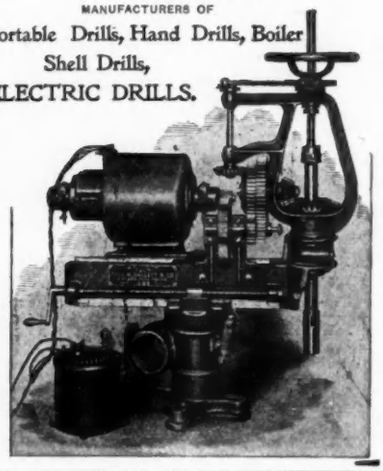

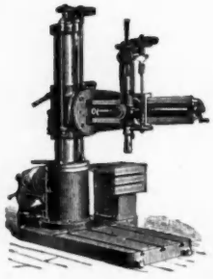

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25 x 10 Perkins, P. Gib.
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26 x 12 New Haven, C. Rest.
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22 x 14 F. E. Reed, C. Rest.
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20 x 11 Wm. Sellars, C. Rest.
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16 x 8 Putnam, R. & F. Rest.
16 x 8 Blaisdell, R. & F. Rest.
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15 x 6 Prentice Bros. R. & F. Rest.
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15 x 6 Flather, P. Gib Rest.
14 x 6 S. Ashton Hand, P. G. Rest.
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48 in. Car Wheel Borer, Bement.
33 in. " "

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15 in. Hendey, Friction.
12 in. Prentiss, Crank
12 in. Warren Trav. Head.

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No. 1 " Garvin.
No. 4 Plain, Garvin.
No. 3 Plain, no arm, Garvin.
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MISCELLANEOUS.

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16 in. x 6 ft., Perkins.
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20 in. x 7 ft., Chamberlain.
20 in. x 8 ft., Pond.
20 in. x 15 ft., Pond.
22 in. x 12 ft., Perkins.
24 in. x 12 ft., Reed.
24 in. x 12 ft., Fitchburg.
26 in. x 10 ft., Lathe & Morse.
28 in. x 12 ft., Freeland.
32 in. x 16 ft., Waterman.
72 in. x 20 ft., triple geared.

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16 in., Aurora.
22 in., complete, Snyder.
24 in., complete, Ames.
25 in., complete, Blaisdell.
84 in., Radial, Betts.

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20 in. x 5 ft., Hendey.
26 in. x 8 ft., Sellers.
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26 in. x 6 ft., Whitcomb.
26 in. x 8 ft., Draper.
28 in. x 5 1-2 ft., Gage.
30 in. x 6 ft., Pease.
30 in. x 6 ft., Pond.
32 in. x 8 ft., Pond.
36 in. x 10 ft., Pond.
36 in. x 14 ft., Betts.
37 in. x 11 ft., Betts.
48 in. x 16 ft., Putnam.

SHAPERS.

16 in. stroke, Boynton.
10 in. stroke, crank, heavy.
15 in. stroke, Hendey.
16 in. stroke, Jeungst.
22 in. stroke, geared, Imp.
24 in. stroke, Hendey.
24 in. stroke, Walter.
10 in. Trav. head, Wood-Light.
12 in. " Warren.
14 in. " Fitchburg.
14 in. " Pratt & Whitney.

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Gear Cutter, 54 in.
Milling Machine.

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15 in. x 6 ft., Porter Machine Works.
16 in. x 6 ft., Blaisdell.
16 in. x 6 ft., Dexter Machine Works.
16 in. x 6 ft., Lodge & Davis.
16 in. x 8 ft., Fitchburg.
18 in. 10 ft., Blaisdell.
18 in. x 10 ft., Flather & Co.
18 in. x 6 ft., Bradford.
21 in. x 8 ft., Lodge & Davis.
22 in. x 8 ft., Blaisdell.
26 in. x 16 ft., Jones & Lamson.
34 in. x 20 ft., F. S. Perkins.

PLANERS.

17 in., Whitcomb, crank.
16 in. x 16 in. x 3 ft., Pratt & Whitney.
24 in. x 24 in. x 5 ft., Gray.
24 in. x 24 in. x 8 ft., Fitchburg.
26 in. x 26 in. x 6 ft., D.W. Pond.
22 in. x 22 in. x 5 ft., Pease.

SHAPERS.

6 in., Boynton & Plummer, for hand.
10 in., Hewes & Phillips, crank.
10 in., Juengst, crank.
15 in., Hendey, friction.
15 in., Lodge & Davis, crank.
15 in., Smith & Mills, crank.
15 in., Chase, crank.
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1-Spindle Garvin Profiler.
25 in. Pond Drill Press.
No. 2 4-Spindle Pratt & Whitney Drill.
No. 20 Hibbard Power Press.
No. 2 Pratt & Whitney Automatic Bolt Cutter.
No. 2 Garvin Automatic Gear Cutter.
21 in. Prentice Drill Press.
No. 1 Garvin Lincoln Miller.
No. 3 Garvin Lincoln Miller.
Prentice Bros. Suspension Drill.
No. 1 Pratt & Whitney Screw Machine.
No. 5 Brown & Sharpe Screw Machine.
No. 2 Springfield Tool Grinder.
No. 2 Garvin 3-Spindle Drill.
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3 in. Armstrong Pipe Machine.
26 in. New Haven Drill.

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1 12 in. x 5 ft., Young.
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1 No. 38 S., 15 in. x 6 in., Harris.
1 15 in. x 6 ft., Blaisdell.
1 15 in. x 6 ft., P. & W.
1 No. 18 C., 18 in. x 6 ft., L. & D., Compound Rest & Taper Attachment.
1 No. 19 C., 18 in. x 6 ft., L. & D., Compound Rest & Taper Attachment.
1 No. 20 C., 18 in. x 6 ft., L. & D., Compound Rest & Taper Attachment.
1 19 in. x 6 ft., Heavy F.
2 20 in. x 11 ft., Lathe & Morse.
1 No. 37 S., 20 in. x 10 ft., Lincoln.
1 No. 3 C., 21 in. x 10 ft., P. & W., Taper.
1 No. 6 C., 22 in. x 9 ft., P. & W., Taper.
1 No. 5 C., 22 in. x 10 ft., Niles, Taper.
1 No. 25 S., 23 in. x 10 ft., J. D. White, Taper.
1 24 in. x 16 ft., Nicholson & Waterman.
1 26 in. x 10 ft., Dustin & Hubbard.
1 No. 49 S., 27 in. x 12 ft., Wood & Light.
1 No. 50 S., 28 in. x 12 ft., Wood & Light.
1 No. 9 S., 28 in. x 16 ft., Wood & Light.
1 30 in. x 12 ft., Lathe & Morse new.
1 No. 44 S., 30 in. x 14 ft., Lincoln.
1 No. 45 S., 32 in. x 13 ft., Bement & Dougherty.
1 No. 46 S., 36 in. x 12 ft., Lincoln.
1 No. 19 S., 40 in. x 16 ft., Wood & Light.
1 No. 61 S., 48 in. x 18 ft., Gay & Silver.

PLANERS.

1 B., 20 in. x 20 in. x 4 ft., Fitchburg.
1 No. 10 S., 24 in. x 24 in. x 4 ft., Wood & Light.
1 No. 11 S., 24 in. x 24 in. x 4 ft., Wood & Light.
1 No. B., 24 in. x 24 in. x 4 ft., Pond. Mch. Tool Co.
1 No. B., 24 in. x 24 in. x 4 ft., Pond. Mch. Tool Co.
1 No. B., 24 in. x 24 in. x 5 ft., Pond. Mch. Tool Co.
1 No. 51 S., 24 in. x 24 in. x 5 ft. 6 in., Wood & Light.
1 H., 24 in. x 24 in. x 6 ft., Lathe & Morse.
1 No. B., 26 in. x 26 in. x 6 ft., Pond. Mch. Tool Co.
1 No. 16 S., 28 in. x 28 in. x 8 ft., Gay & Silver, Heavy.
1 No. 14 S., 32 in. x 32 in. x 10 ft., Wood & Light.
1 No. B., 36 in. x 36 in. x 9 ft., New Haven.
1 No. P., 36 in. x 36 in. x 9 ft., English.
1 No. B., 36 in. x 36 in. x 10 ft., Pond Mch. Tool Co.
1 No. P., 36 in. x 36 in. x 14 ft., Powell.
1 No. 13 S., 38 in. x 38 in. x 10 ft., Aldrich & Co.
1 No. 17 S., 32 in. x 10 ft., Van Horn, Open Side Planer.
1 No. 127 C., 48 in. x 32 in. x 8 ft., Pond. Mch. Tool Co., 2 heads.
1 No. 128 C., 48 in. x 32 in. x 6 ft., Pond. Mch. Tool Co., 2 heads.
1 No. 129 C., 48 in. x 32 in. x 6 ft., Pond. Mch. Tool Co. 2 heads.
1 No. 130 C., 48 in. x 32 in. x 6 ft., Pond. Mch. Tool Co., 2 heads.
1 No. H., 60 in. x 60 in. x 15 ft., Niles Tool Works Co., 3 Heads.
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Shriver & Co., T., New York.

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Nolte Brass Co., Springfield, O.

Castings, Steel.
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Slocomb & Co., J. T., Providence, R. I.

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Cushman Chuck Co., Hartford, Conn.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Horton & Son Co., E., Windsor Locks, Conn.
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Skinner Chuck Co., New Britain, Conn.
Trump Bros. Machine Co., Wilmington, Del.
Wiley & Russell Mfg. Co., Greenfield, Mass.
Whiton Machine Co., D. E., New London, Conn.

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Dallett & Co., Thos. H., Philadelphia, Pa.
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Davis & Egan Machine Tool Co., The, Cincinnati, O.
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Continued on page 30.

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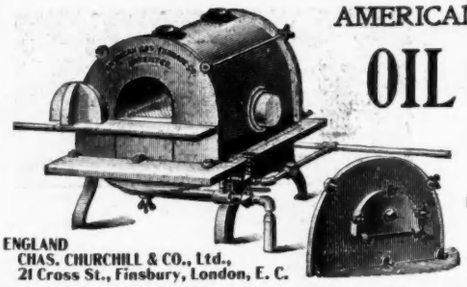
Continued on page 31.



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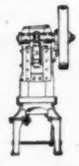

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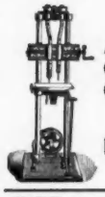

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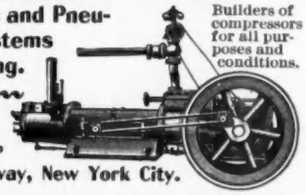

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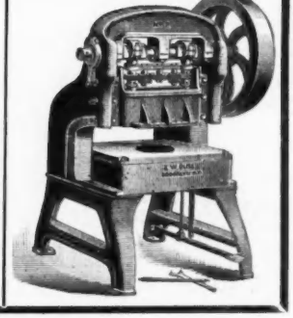

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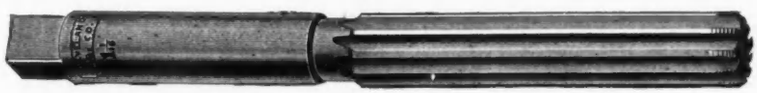

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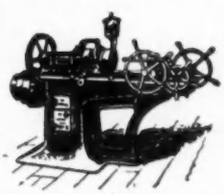

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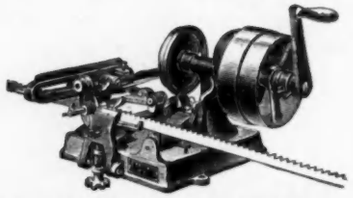

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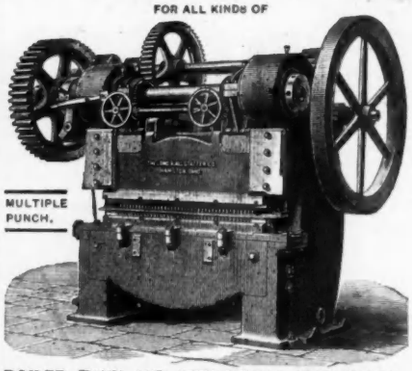

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